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INDEX TO CONTENTS, PAGE 305 - - - - - - - - - ADVERTISERS' INDEX, PAGE 22.

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SMITHSONIAN DEPOSIT

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STEEL CONSTRUCTION

Pittsburgh

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OF

AIR AND STEAM SUPPLY

(PATENTED),

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PRODUCING { UNIFORM RESULTS. HIGHEST EFFICIENCIES.

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GAS LIGHT JOURNAL
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CONTENTS.

An Asterisk (*) Denotes an Illustrated Article.

*Welding and Cutting of Metals in the Gas Industry, by H. P. Harding 305
New Business Methods, by Mr. E. M. Stack 308
The Distribution of Heat in the Operation of Steam Boilers, by Perry Barker 309
Removing Carbon from Gas Engines, by J. A. Anglada 311
OFFICIAL ANNOUNCEMENT—
Tenth Annual Meeting, Iowa District Gas Association 312
EDITORIALS—
Annual Meeting, Wisconsin Gas Association.—[Special Editorial Correspondence, by Telegraph] 312
Briefly Told 313
Compressed Gas Moved by Motor Cars—A Change in Engineering Education—Allied Gas and Electric Companies of New York Occupy New Building Together—Object to Trust Bill—Brooklyn, N. Y., Engineers Club—As a Means for Obtaining Efficiency—Co-operative Investment.
Efficient Administration of the Operating Department as an Aid to New Business, by John A. Clark, Jr 314
Address of the President (Mr. James Ferrier) of the Southern Gas Association, Mobile, Ala 315
Some Recent Street Lighting Problems, by J. R. Cravath 316
The Liquid Contraction of Cast Iron 317
NEW METHODS AND APPLIANCES 317
*Retort Setting for Varying Output—*Automatic Self-Adjusting Wrench.
Recent Patent Issues 318
ITEMS OF INTEREST FROM VARIOUS LOCALITIES 318
Improved Easton (Pa.) Plant—Light at Barnegat, N. J.—J. G. White Engineering Corporation to Inventory, Washington, D. C.—Toronto Concert—Gas Appliances Wanted—Richmond Inspectors—Iroquois Natural Gas Company to Sell Gas for Lighting—Mr. W. E. Barrett to Examine Newport News Plant—Fire in Generator House—South Groveland, Mass., Gets Gas—Portsmouth, N. H., Exhibit—Columbus Gas and Fuel Company—Prof. Bemis Building a Nest—Chicago Bids for Ornamental Gas Lamps—Gas in Sandwich, Ills. Stockholders Committee Elect Director—Object to Paying Twice—Contest for Franchise in Johnson City, Tenn.—To Amend Charter for Heat Units—Grand Rapids Company Dines Coal Dealers—And Other Items.
UTILITIES COMMISSION NEWS 320
Illinois Companies Must Revert to Former Rates—New Jersey Policy in Dealing with Municipal Regulation—Findlay, O., to Protect Its Pipes—Municipal Lighting Plant at Sheboygan Not Desirable—Utica Reduction.
Financial Notes 320
Public Lighting Table for May, 1914 .....(Advertising Section) 10
Meeting Times of the Various Gas Associations " 27

Welding and Cutting of Metals in the Gas Industry.[1]

[Prepared by H. P. HARDING, for the Illinois Gas Association.]

Autogenous welding, which has come to be the accepted name for the welding methods developed in the last few years, is really a misnomer, literally meaning self-welded or welding by means of heat alone. Some authorities have, in the last year or so, attempted to change this to the better term, fusion welding.

The two methods of electric welding, resistance and arc welding, are not at all similar, except that both use electric current for obtaining the welding temperature. Resistance welding is particularly applicable to small, similar sections, including chain, tubing, and wire. In spite of the best care, results obtained by arc welding are not uniform and the welds are occasionally very hard. Thermit welding, or the alumino-thermic process, limited in its field, being suitable for only heavy, massive work, such as the welding of large shafts, stern posts of ships, and heavy castings. It cannot be used for repairing the class of work for which oxy-acetylene is used, such as tanks, boilers, moderately thick castings, filling in blow holes, etc.

Although the oxy-hydrogen flame is older than the oxy-acetylene, its use has not advanced so rapidly. The oxy-hydrogen flame is longer than the oxy-acetylene, and therefore, capable of cutting greater thickness of steel. For very thin metals of low fusibility, it requires less skill, because it is less liable to burn through. This leaves for oxy-acetylene the vast field of welding work, above the very thinnest sheet, and cutting everything below 12-inch thickness.

Acetylene was discovered in 1836, by Sir Humphry Davy, but its generation on a large scale was not possible until the commercial development of calcium carbide, in the early nineties. Acetylene contains 92.3 per cent. carbon and 7.7 per cent. hydrogen, and is, therefore, nearly gaseous carbon. It gives about five times as much heat per cubic foot as hydrogen, and gives a flame of greater intensiy, 6,300° F.

There are two recognized systems of generating acetylene:

The low pressure system delivers the acetylene directly from the generator to the blowpipe, under a pressure of but a few ounces, a gas bell being used to maintaiu uniform pressure, which is an absolute essential.

The high pressure system delivers the acetylene to the blowpipe under pressure of more than 1 pound per square inch; either from a generator operating under 15 pounds pressure or by acetylene compressed or dissolved in tanks. These cylinders are packed with asbestos and commonly filled with acetone, which is capable of absorbing 25 times its volume of acetylene for each atmosphere pressure. A diaphragm reducer is used to cut down the pressure before entering the blowpipe, the system giving excellent results, especially where portability is essential. Both systems have their advantages, but the low pressure system is more generally recognized in this country and abroad as completely fulfilling the problems that the process is called upon to solve.

Oxygen is generated either chemically, by electrolysis from water, or is obtained from the atmosphere. The chemical method is used only to a very limited extent, because of the difficulty of eliminating the chlorine, which has a tendency to impair the weld. In the electrolysis method an electric current is passed through water containing a small amount of sulphuric acid, which acts as an electrolyte, setting free the hydrogen and oxygen, which collect at the negative and positive poles, respectively. In obtaining oxygen from the atmosphere the air is compressed adiabatically in a five-stage compressor, the heat of compression removed after each stage by a water cooler. Carbon dioxide is removed before compression, by passing the air through lime, and all traces of moisture by passing through calcium chloride before entering the coolers. The oxygen becomes liquid while the nitrogen is still gaseous, and is drawn off, expanded and compressed into cylinders ready for service. The process perfected by Dr. Carl Linde is the simplest, must efficient, and purest of the atmospheric systems.

Attention was called to the high temperature of acetylene in 1895, but no advantage was taken of it until 1901, when Fouchè and Pickard diluted acetylene to prevent "flashing back," and made a blowpipe which worked fairly well. A year later the dilution was overcome by using a high pressure torch, but this was not satisfactory because it blew the metal away. In 1903 Fouchè introduced the low pressure torch in which the injector action is used, and in the

1. Slightly abridged.—EDS.

same year the intermediate torch, known in the United States as the high pressure torch, was brought out.

In the Fouchè torch the injector oxygen is admitted under fairly high pressure and draws in the acetylene. This torch uses either dissolved acetylene, or acetylene from either low pressure or high pressure generators. The pressure type of torch uses both gases under pressure of a few pounds, consequently it must be supplied with dissolved acetylene or acetylene from a high pressure generator. In the cutting torch several small oxy-acetylene jets pre-heat the work for an additional jet of oxygen, part of the metal being removed as an oxide, and the heat of combustion melts the rest so that it runs out of the cut.

Theoretically the proportion of the gases is two of acetylene to five of oxygen, which combine to form four volumes of carbon dioxide and two of water vapor. This reaction is not completed in the inner cone, the acetylene and oxygen burning there to carbon monoxide and hydrogen, the further combination occurs in the outer envelope, most of the oxygen in this second step being taken from the surrounding air. The tip of the inner cone is the working point of the flame, although its total heat is less than that of the outer envelope. The outer serves three functions; to preheat the work for the inner cone; to prevent the inner cone from being cooled by the inert nitrogen of the air; and to protect the molten metal from oxidization, the combining carbon monoxide and hydrogen having a greater affinity for oxygen than the metal.

In operating the welding blowpipe the flame should be kept neutral, that is, there should be no excess acetylene, which would tend to carbonize the metal, nor an access of oxygen which would tend to oxidize it. Excess acetylene can be detected by the double inner cone, one longer and less luminous than the other. An excess of oxygen gives a feathery end to the inner cone. Further, a carbonizing flame will cause the metal to glow, while an oxidizing flame will cause the metal to boil. The quantity of gases admitted to the blowpipe is controlled by a regulator, which serves as a reducing valve to maintain any set constant pressure. A gauge on the blowpipe side of the regulator indicates the torch pressure, and one can be used on the supply side to indicate the depletion of the gas in the cylinder.

The high temperature of the oxy-acetylene flame enables the operator to bring the metal to a molten condition before the heat is conducted or radiated away. Some of the heat is conducted away, but it is not entirely lost since it assists in reducing trouble from expansion and contraction in the surrounding body. Internal strains are set up in every process of welding, by expansion and contraction often sufficient to crack the metal. This is more especially true when welding brittle, inelastic metals, such as cast-iron, and when the local strains exceed the strength of the material, fracture is bound to occur. The more ductile the material the better it is capable of withstanding strains of this sort. To relieve a welded piece of these strains, it is desirable to preheat before and re-heat after welding. Molecular re-arrangement will then bring forth a redistribution, if not actual elimination of the excessive strains. This treatment is essential for cast-iron, but it is not as important for steel or wrought-iron. For large work it is usually impossible to heat the entire body, but it is well to heat the work for a considerable area around the weld both before and after welding.

In welding sheet metal of greater thickness than ¼-inch, it is advisable to cut a "V-groove" along the edge to be welded to permit penetration of the flame. It is usually necessary, except with thin sheets, to add metal from a filler rod or wire. After the metal at the joint is in running condition molten metal is added drop by drop from the filler rod until the groove is filled. Sometimes an access is added to insure the strength of the weld. If dissimilar metals are to be welded, a welding rod of the one which welds at the lowest temperature is used so that the added metal will not chill when falling upon the molten metal. A flux is needed when welding cast-iron, aluminum, brasses, bronzes, etc., to prevent oxidation, to remove the scale, and make the metal more fluid.

The strength of the weld is always greater than 85 per cent. of that of the original material, the loss due to the inferior material of the welding rod or to the interial strains set up by expansion and contraction. The structure of the weld is not quite as homogeneous as other parts of the piece, but this is controlled largely by the skill of the operator. By hammering at the right moment on the welded part, the metal can always be made denser, thus increasing the strength of the weld. A skilled welder uses a hammer as freely as he does the blowpipe.

Flame welding is rapidly making its way into every branch of the metal working art, especially oxy-acetylene welding. In volume of work done, America leads the world, with Germany second, France third and England a rather poor fourth. In scientific research and special development, Germany leads all other countries, due to the fact that the German government has established schools at various places where the art is taught as one of the applied sciences. They are making piping of all sizes, by rolling flat plate and welding by oxy-acetylene torch. Pipe is also being laid without threads or flange joints, of about one half the thickness of our standard pipe, thereby saving greatly in material costs, Fig 1 shows a view in a shop where

Fig. 1.—Welding Branches into Mains.

they are welding branches into mains and headers instead of using fittings. This saves materially in space and avoids the necessity of caulking.

Interior parts are often welded in apparatus similar to the seal pot illustrated in Fig. 2, which shows an operator welding a 6 inch pipe

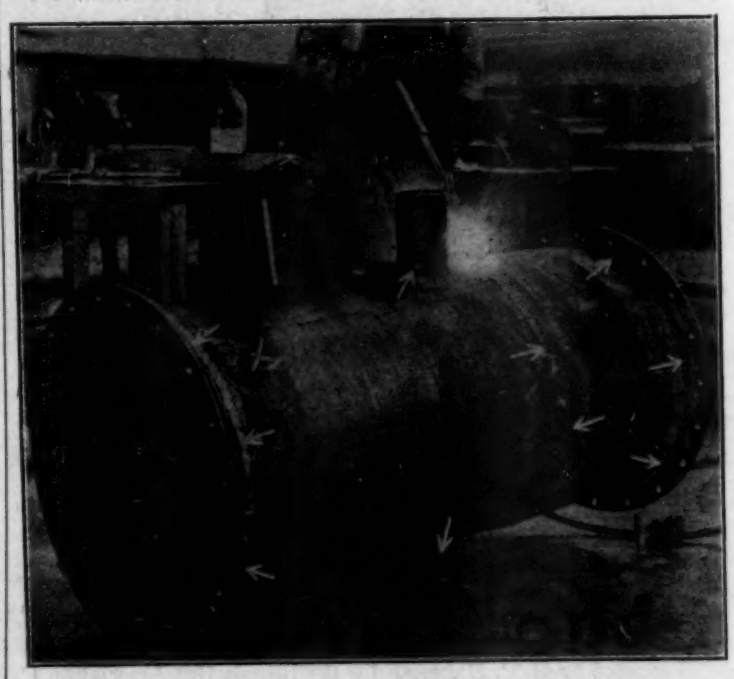

Fig. 2.—Welding Nipple Onto a Tank.

nipple to the tank. This pot was of $\frac{5}{16}$-inch plate, 30 inches in diameter and 3 feet 9 inches high. A total of 29 feet 8 inches of welding was done, which included 2 head and 1 longitudinal seams, three 6-inch pipe couplings, two 6-inch pipe nipples, one 1-inch coupling, and one 6-inch right angle bend. All cut-outs were made with the blow-pipe, including the holes for couplings and nipples, making a total of 9 feet 11 inches of linear cutting. The cost of doing this work, including gases, labor, and filling material was $26.92.

A 200-pound cast-iron cylinder was badly broken in two places The cracked section was chipped out and the casting welded, putting it in as good condition as a new casting. The cost of a new casting would have been $50.00. The welding cost was less than $2.50, a

Fig. 3.—Cylinder Chipped Ready for Welding.

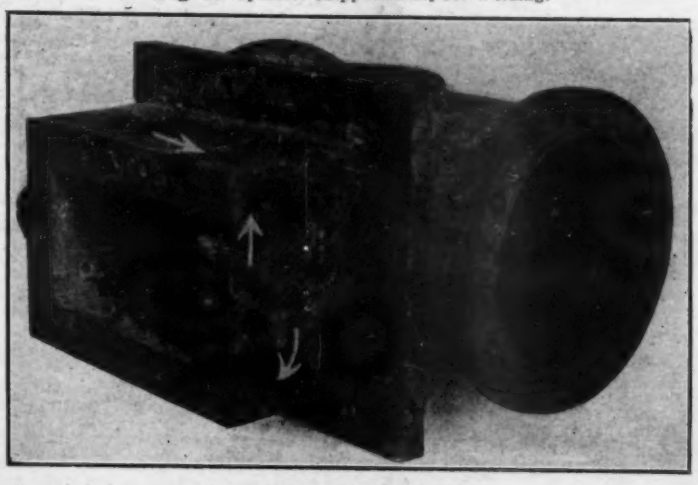

Fig. 4.—Welded Cylinder.

saving of over $47.50, besides the delay which would have been necessary if a new casting had been ordered.

Lugs which have been broken off of boiler fronts and fire doors can be welded in about 40 minutes, at a cost of about $1.40. The boiler front illustrated in Fig. 5 was brought to a local job welding shop to

Fig. 5.—Welding Lug on Boiler Front.

be repaired. If a welding outfit had been available in the boiler plant the broken lugs could have been welded on while the front was still in position.

The water cooled valve front of a blast furnace main, Fig. 6, blew

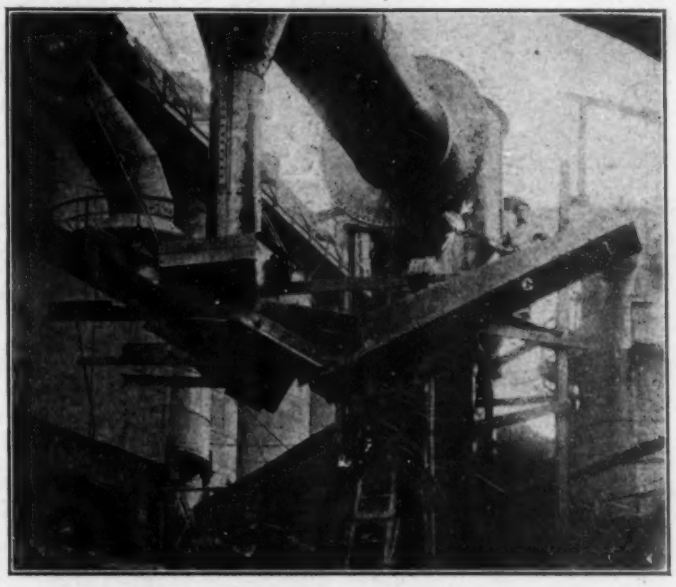

Fig. 6.—Welding Cracked Blast Furnace Main.

out and cracked in several places. The ordinary method of repairing this trouble would have been to patch up the cracks, using ordinary flue patches, at a cost of approximately $2,000, and necessitating shutting down four of the furnaces for at least 10 days. The cracks were welded with the oxy-acetylene welding blowpipe in about 8 hours, at a cost of approximately $25.00. One of the welded cracks is indicated by the arrows at the right of the illustration. The others are at the rear of the valve and do not show.

In garages, the welding blowpipe has come to be a necessary fixture. The frame of a 5 ton auto truck had cracked through, just back of the front wheels (Fig. 7). The cost of replacing this frame,

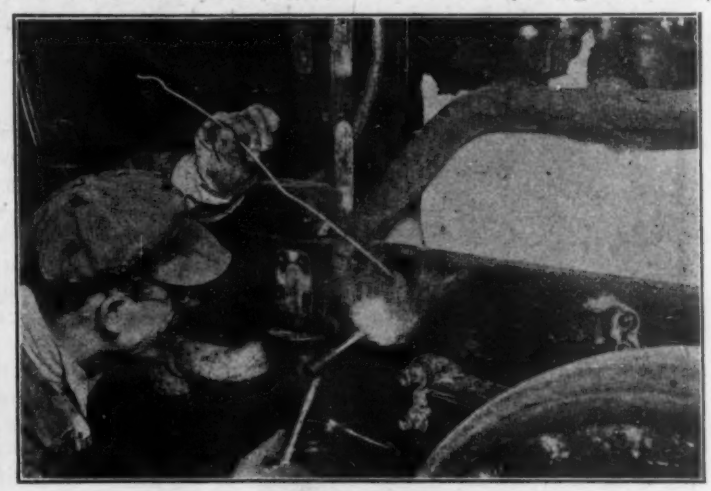

Fig. 7.—Welding a Cracked Auto Frame.

including the loss of revenue, for the time out of service, would have been $500 to $550. The break was welded with an absolute guarantee for less than $20.

It has always been a serious problem to remove the lead pipe in joint. This problem has been solved by using a small oxy-acetylene blow-pipe, the flame confined to the lead without affecting the pipe. With a hammer and chisel it usually takes a man a day to a day and a-half to remove the lead from a 40 inch bell. The lead was melted out with the blowpipe in one hour and a half, making a cleaner job and not injuring the pipe in the slightest.

In the wrecking of the Trude Building, Chicago, the oxy-acetylene cutting blowpipe was a big factor in completing the work of demolition in contract time (Fig. 9). As the steel girders and beams were a standard length, the majority of the work was confined to cutting off the rivet heads and driving the body of the rivets out, which was done in 30 seconds each. The average cost of cutting the steel with the oxy-acetylene blowpipe was about $4 per ton.

Fig. 8.—Removing Lead From Pipe Joint.

Fig. 9.—Cutting Structural Steel.

Fig. 10.—Cutting Steel Reinforcing Rods.

In wrecking reinforced concrete structures, the oxy-acetylene cutting blowpipe can be used to cut the reinforcing rods. Two-inch reinforcing rods, which it would have taken from 30 to 40 minutes to cut with a hacksaw, were cut with the blowpipe in 30 seconds.

These illustrations show the many kinds of work being done with the blowpipe. The special application of the apparatus to the needs of gas manufacturers will include many of the repairs and other operations shown.

At the Panama-Pacific Exposition, a very interesting feature of the construction of gas and water piping is that every joint throughout the entire grounds has been welded with the oxy-acetylene blowpipe, eliminating the large amount of additional iron necessary for fittings, and simplifying the construction of the piping.

An instance of considerable interest to the gas manufacturer is the welding of lamp posts in Dayton, O, During the recent flood about 150 of the ornamental cluster poles were broken off about 18 inches above the ground. To take up the concrete in the street and reset the poles, would have been a very expensive operation, therefore the oxy-acetylene blowpipe was used, and the poles welded efficiently and economically. A special derrick-wagon was used, on which was mounted an acetylene generator and the oxygen cylinders, with the necessary tools. The wagon was backed up to the stub of each pole, the broken part raised to its original position, the breaks matched up and the joints prepared for welding. The weld was probably stronger than the original casting, as one-eight inch fillet was added.

In many cities there are lamp posts of sheet metal attractively fluted and pressed. In the manufacture of these columns, a sheet of the proper size is selected, suitably tapered and the longitudinal seam welded with the blowpipe. The fluting is then done by dies of various kinds, the base and top suitably pressed to give a pleasing appearance. Such posts are very much lighter than the cast iron posts, are practically indestructable, and, if desired, may be filled with concrete, which gives very substantial construction.

In direct connection with gas manufacturing plants, there are, of course, many operations to which the blowpipe may be applied with economy. Among these are the repairing of furnace door frames, large heavy posts, hydraulic rams, pumping machinery, wrecking of old gas holders, structural work, etc., cutting man holes through steel tanks or required repairs to boilers, etc., etc.

A gas pipe joint, recently developed abroad, and giving good service, is "Stewart's patent long sleeve welded joint." This is made by tappering slightly the spigot end, which is a driving fit, into a correspondingly tapered bell, the latter having a slightly belled mouth on which the welded joint is made. The close fit of the two tapered surfaces relieves the weld of transvere bending stresses. The belled mouth serves a two-fold purpose—first, of facilitating the entry of the spigot end of one pipe into the socket end of the next; second, of affording a long contact surface for the weld.

In conclusion, it may be conservatively stated that the flexibility of the blowpipe is such that there are an infinite number of uses for it in almost every plant where iron and steel, structural work or machinery is dealt with.

New Business Methods.

[Prepared by Mr. E. M. Stack, for Sixth Meeting, Pennsylvania Gas Association.]

It may not be inexpedient at the very beginning to call your attention to the title of this article.

There has never been a gas convention known of by me, that has not been favored with an able and interesting paper on this subject. Very naturally, therefore, I feel considerable embarrassment in attempting a subject which has been so frequently discussed. You, therefore, also realize in a manner the difficulty I will have in making it interesting or profitable.

The time allotted to me will permit but brief reference to these New Business Methods, as I understand and apply them in various branches of the industry. I will not, in any phase, consider the manufacture, operating, accounting, meter, or physical condition of properties. For the present, I assume that all of these branches are scientifically and economically operated and maintained up to the delivery of gas to the sales department.

There may be some things that the world cannot improve upon, and any attempt to make such things better is time wasted. Not so with "New Business Methods" as applied to the gas industry.

It is related of Stephen Girard, that he collected crooked nails and straightened them for use. Girard did not become wealthy on reclaimed nails, but he did become so because he habitually invented or attempted new business methods, even in that day, applying them to the little things, as well as the most important factors in business promotion.

A gas company will not become prosperous by selling gas irons, bread toasters and other small gas consuming appliances, from the immediate profits of the sales, but it will take a mighty step in that direction, by increasing gas output through a liberal use of small consuming devices. The success of today depends, at least, to a great extent, if not entirely, upon the exercise of intelligent business management. While it is essential that such a management be watchful of the service rendered present consumers, at the same time it should be extremely active in the search for new business, studing its individual problems in detail and devising new and original methods for securing it. The two endeavors, namely the retention of the old business and the active pursuit of the new—will synchronize, and the result is a magnified increase in the consumption of gas by old and new customers. But we must be everlastingly "hitting the trail" along all

avenues, for new and increased gas sales, neglecting no expedient or device calculated to produce results.

Every business stands or falls according to its management. Get the right kind of men in our commercial or selling department, assign and manage these men with judgment, and we have taken the first and most important step in the fundamentals of New Business Methods. My purpose is to convey to you my plans for increasing and holding fast to all kinds of gas business, bearing in mind at the same time that by our profits we live.

We are all aware that the keenest executive and engineering minds are now at work on this very problem; they are all trying to increase earnings by increasing gas sales and decreasing per unit, operating expenses. I believe in making business where there is no business, and increasing business where we now have business. It is of paramount importance that there be co-operation between all the departments of a gas company, in order to eliminate friction, and thereby promote the harmonious working of the whole organization. This is an age of rampant competition, and is therefore essentially an age constantly producing New Business Methods. I assume—

1. That the gas company is unrestricted in its field of operation and has no coalition of interests with the electric companies.
2. That the gas company is independently operating the plant for healthy and profitable gains, asking no quarters from a keen electric competitor.
3. That the gas management is permitted to go forward unhampered, at full speed, for all kinds of profitable gas sales.

Under these assumed conditions, if gas sales do not show satisfactory increases, there is unquestionably something wrong with the management.

It is his moment to wake up and brush away the cobwebs and barnacles from the situation; discarding the old way of doing things, or not doing them. He should adopt new ways and means. This is squarely up to the manager, who is entrusted with the direction and the development of the business, and to show results, and he will do it if he rings true. This is a large factor in my solution of New Business Methods.

The trouble with most of us is that after making a splurge—a sort of a splash in business-getting for a period, we then begin to slow up, pat ourselves on the back and say, "well done." All wrong; in this way continued success is not possible; we cannot hibernate for a moment; we must advance with all new and original plans, ideas and propositions to the public. If we do not we are lost in the shuffle or brushed aside by our competitors.

No live progressive gas company will be satisfied with the crumbs from its competitor's table, not at all; we must originate new methods and offer attractive propositions. We must have business initiative, must lead, not follow. New ideas we must commercialize and advance; not slowly following in the wake of others; we must do things and not dream that we did them.

I will briefly touch upon a few methods which I have successfully tried out in Scranton, and therefore recommend:

Opposed to renting arc lamps, both for interior and exterior lighting, I have abolished that scheme. I believe, however, in selling arc lamps and bristling the business sections of the city with them. It is my experience that it makes a permanent consumer and prevents one continuous operation of installing and re-installing arc lamps, as we did with the rented ones. These arc lamps should be sold on the deferred payment plan, and at the expiration of the purchase term the title to be vested in the consumer. I believe in the ultimate abolition of all maintenance of rental charges, and am now working to accomplish that result. The consumer should be charged for only the actual number of mantles used in his installation of lamps, or given the option of paying 25 cents per month, as an expense for renewals. These charges should be ultimately abandoned. It is my experience that it is good business on the part of the gas company to assume full responsibility for the correct operation of gas arc lamps, and keep them in first-class lighting and operating condition, free of cost to the consumer, save the cost of mantles, thereby putting the proper operation and illumination of the lamps squarely up to the gas company, where it undoubtedly belongs. I consider arc lighting the cream of the lighting business, and we should therefore be indefatigable in our efforts to secure it. The companies which are content to continue the old rental systems for gas arcs, will soon realize that, in a keen competitive field, the requiem of that class of business is being sung.

I find that each consumer who purchases his installation of arc lamps feels a personal interest in their ownership, thereby forming an agreeable partnership between the consumer and the gas company, in endeavoring to give and secure the best results. I find that in order to hold fast to the gas lighting business, making it pay in this age and generation, that we must make our installations attractive in appearance, economical in operation and scientific in construction. As there is no lighting problem that we cannot solve with gas, I believe that we should secure the lion's share of all commercial and residental lighting, by contesting every inch of the ground.

I consider it good business to install large numbers of gas ranges yearly, on a free trial basis, making it optional with the consumer to purchase the ranges at the expiration of the trial period. I have put out thousands of ranges on these conditions, and have been obliged to remove less than 1 per cent. of them. The same system holds good in water heaters, industrial appliances and all other gas consuming apparatus, both large and small. I believe in giving the consumer every opportunity to try out and test our recommendations. It will result in profitable gas gains.

I believe in pushing installations of every known gas consuming appliances that is applicable to the various shops and factories—the field for industrial appliances is wonderfully fertile and should be intelligently worked.

I believe in educating our gas salesmen or commercial engineers along all lines of gas consuming devices, in mechanical construction, operating and selling methods, and I believe that they should also be educated up to the minute in scientific illumination and selling spirit. I am an advocate of original and judicious advertising, the kind that creates a demand and results in an extra consumption of our commodity.

Now, in conclusion, I will note that I have referred but incidentally to a few specific examples of my methods in securing business. I consider that the success of any gas company depends absolutely upon its men, and their combined talents and energies. The business methods of the gas company is but the lengthened shadows of the men at its head.

It is of paramount importance to have a high standard of men to produce a wide range of gas consumption. We must have their combined thoughts and expressions, from the highest to the lowest, in order to conceive and execute "New Business Methods."

It should always be remembered, too, that as servants of the public, their comforts and convenience claim from us the highest regard and the most unremitting attention. In that way, and in that way only, can a company be carried, yielding satisfactory profits to the ownership and at the same time, satisfactory service to the people.

The Distribution of Heat in the Operation of Steam Boilers.[1]

By Perry Barker.

In combustion of coal in boiler furnaces a comparatively large percentage of the heat in the fuel is not usefully employed. The extent of the losses which affect the boiler efficiency is governed by (a) the design and physical condition of the plant, (b) the personal element in the operation of the boilers, (c) the character and adaptability of the fuel for the plant in question, and (d) the rate of steam generation or capacity at which the boiler is operated. The efficiency with which fuel is burned is controlled by these factors, and excessive losses may be due to one or a combination of them.

The Power Tests Committee of the American Society of Mechauical Engineers, recommend that a balance accounting for the distribution of heat in a pound of dry coal fired consist of the following items:

1. Heat absorbed by the boiler.
2. Loss due to evaporating and superheating moisture in coal.
3. Loss due to evaporating and superheating moisture formed by the combustion of hydrogen and distillation of oxygen-hydrogen compounds in the coal.
4. Loss due to heat carried away by dry flue gases leaving the boiler.
5. Loss due to heat escaping through the formation of carbon monoxide (CO).
6. Loss due to combustible removed from ash pits and from grates during cleaning.
7. Loss due to superheating moisture in the air used for combustion.

1, Paper presented at the Boston Meeting of the American Institute of Chemical Engineers.

8. Loss due to unconsumed hydrogen and hydro-carbons, to radiation, and unaccounted for.

Items 4, 5 and 6 generally cover about 75 per cent. of the total heat lost, and are the variable factors which have a direct effect on the percentage of heat imparted to the water in the generation of steam. In presenting certain data on these losses, illustrations of the origin, extent and methods which have been employed for their reduction, are submitted.

The loss generally largest and in most cases easily reduced, is the heat carried away by the dry flue gases. Under this heading are included the sensible heat in the carbon dioxide and carbon monoxide formed by the combustion of the carbon in the fuel, and the heat in the air in excess of that theoretically required, leaving the boiler at the temperature of the escaping gases.

The principal causes of this loss are as follows:

(a) Improper methods of firing, allowing large quantities of air to enter the furnace either through the grates or fire doors.

(b) Condition of boiler settings. If the settings are cracked and the iron work warped, the air drawn through these openings, reduces the draft at the grate, and dilute and cool the gases as they pass over the heating surface.

(c) Poor quality coal. Coals containing high percentage of ash or having a tendency to clinker cause an uneven distribution of the air through the fuel bed. When such a condition exists, excess air enters the furnace and carried away heat in the flue gases. If the fuel is too fine, it will pack on the grate and produce a similar effect.

This loss depends upon the weight of gases per pound of carbon burned and the temperature at which these gases leave the boiler. The data required for this computation are the temperature of the flue gases, temperature of the boiler room, composition of the flue gases, heating value of the coal, and the carbon content of the fuel and ash pit refuse.

Some tests in a plant where loss of heat in the flue gases was originally high are shown in Table I. They were hand-fired horizontal return tubular boilers equipped with plain grates, burning Pennsylvania semi-bituminous coal containing about 9.00 per cent. of ash and 22.00 per cent. of volatile. The fires were carried at a thickness not exceeding 7 inches and were uneven, thereby permitting large air excess. The thickness of the fire was then increased and the method of firing altered resulting in a reduction of the loss due to excess air from 36 to 12 per cent., with an increase of 20 per cent. in boiler efficiency. The tests showed that the air excess in the latter tests was lower than could be recommended for regular operation, as considerable carbon monoxide was formed.

TABLE I.—*Loss Due to Heat Carried away by Dry Flue Gases Leaving the Boiler.*

	Original Conditions, Per Cent.	Tests to Improve Efficiency, Per Cent.	
1. Heat carried away by dry flue gases.....	35.9	10.0	12.4
2. Evaporating and superheating moisture in coal, and moisture formation of carbon monoxide.....	0.0	0.4	1.6
3. Evaporating and superheating moisture formed by combustion of hydrogen and distillation of oxyhydrogen compounds.....	2.7	2.7	2.8
4. Loss in combustible removed from the ash pits and from grate during cleaning...	3.2	7.6	4.5
Total determined loss.....	41.8	20.7	21.3
5. Other losses (assumed constant for all tests)	8.9	8.9	8.9
6. Approximate percentage of heat absobred by the boiler or boiler efficiency (by difference)	49.3	70.4	69.8
Total.....	100.0	100.0	100.0

The loss of heat due to the incomplete combustion of carbon to carbon monoxide, is usually important. Carbon monoxide in flue gases is generally accompanied by tar vapors or particles of solid carbon (smoke), together with small percentages of unburned hydrogen and hydrocarbon gases. Its formation is due to the following causes:

(a) Furnaces of poor design.

(b) Improper firing.

(c) The character of the fuel, particularly with reference to the equipment in which it is burned.

While the presence of CO shows that some heat is being lost by incomplete combustion, a small percentage of this constituent generally indicates that the air excess is reduced as low as practicable. A small amount of smoke, as evidence of presence of carbon monoxide, is a better indication of economical furnace operation than a smokeless stack, which may be emitting several hundred per cent. of excess air.

The extent of this loss is dependent upon the percentage of carbon monoxide (CO) and carbon dioxide (CO_2), as determined by the flue gas analysis, the heating value of the coal, and the percentage of carbon in the coal fired and in the ash pit.

Tests in a plant where loss due to unburned gases (indicated by the CO) was particularly high, are shown in Table II. These were hand-fired vertical tubular boilers, with shaking grates, burning Georges Creek coal, containing 18.00 per cent. of volatile. The incomplete combustion was not attributed to the coal, although the furnace space was not sufficient to burn coals containing high percentages of volatile matter without an excessive amount of smoke. Aside from furnace design, the primary cause of high CO was the thickness of the fires. By reducing the thickness from 30 inches to 12 inches, and changing the way of firing, this loss was reduced from 14 to 1 per cent., with a corresponding increase in boiler efficiency.

In firing a boiler a certain percentage of the fuel fed drops through the grate and is removed with the ashes, and additional unburned coal is drawn from the grates in hand-firing, when the fires are cleaned. The amount of fuel thus lost depends on:

(a) The character of the coal.
(b) The condition of the equipment.
(c) The method of handling the fires.

If the coal is fine or non-caking and the grates contain large air spaces, excessive amounts of fuel drops through. Some coals clinker badly, and during the removal of this clinker quantities of unburned coal are drawn from the fires. The frequent baring or raking of fires when using fine or non-caking coal, is another cause of loss.

TABLE II—*Loss Due to Heat Escaping Through the Formation of CO.*

	Original Conditions Per Cent.	Tests to Improve Efficiency Per Cent.	
1. Loss due to heat escaping through the formation of carbon monoxide (CO).....	15.3	1.1	2.1
2. Loss due to evaporating and super heating moisture in coal and moisture formed by the combustion of hydrogen and distillation of oxyhydrogen compounds..	4.1	3.8	4 2
3. Loss due to heat carried away by the dry flue gases.....	9.7	15.1	10.7
4. Loss in combustible removed from the ash Pits and from grate during cleaning..	3.2	3.5	3.3
Total determined loss.....	32.3	23.5	20.3
5. Other losses (assumed constant for all tests.....	11.2	11.2	11.2
6. Approximate percentage of heat absorbed by the boiler or boiler efficiency (by difference)	56.5	65.3	68.5
Total.....	100.0	100.0	100.0

For computing ash pit loss, which includes the combustable removed during cleaning, the heating value of the combustible is taken as 14.600 B.T.U. per pound. In cases where complete boiler tests are not made, and the weights of coal and ash pit refuse are not taken, the fuel removed with the ashes and cleanings can be computed from an analysis of this material and the percentage of ash in the coal fired. In calculating this by the latter method, the assumption must be that the percentage of ash obtained by the proximate analysis of the fuel represents the inert matter in the refuse from the ash pits and the furnace; that is, no account is taken of the ash carried off the grates and deposited in the combustion chamber, upon the water heating surface or carried up the stack. A series of tests, indicating how much this loss can be reduced are submitted in Table III. This plant had inclined grate stokers, burning Pittsburg slack coal. The excessive rate at which the fuel was burned, in order to maintain the required capacity, caused deterioration of the grates, allowing large quantities of unburned coal to fall into the ash pits. By careful attention to grate repairs and methods of

operating the stokers, the boiler efficiency was increased 10 per cent.

TABLE III.—*Loss Due to Combustible Removed from Ash Pits and from Grates During Cleaning.*

	Original Conditions, Per Cent.	Tests to Improve Efficiency, Per Cent	
1. Loss in combustible removed from the ash pits and from grate during cleaning..	13.1	9.1	7.9
2. Loss due to evaporating and superheating moisture in coal and moisture formed by the combustion of hydrogen and distillation of oxyhydrogen compounds.....	3.2	3.3	3.4
3. Heat carried away by dry flue gases.....	22.6	19.1	18.2
4. Heat escaping through the formation of carbon monoxide.....	0.0	0.0	0.0
Total determined losses.....	39.1	31.5	29.5
3. Other losses (assumed constant for all tests).....	7.5	7.5	7.5
6. Approximate percentage of heat absorbed by the boiler or boiler efficiency (by difference).....	53.4	61.0	63.0
Total.....	100.0	100.0	100.0

The percentage of hydrogen in coals is not an indication of their relative value when burned for the generation of steam. The essential feature in determining the effect of this constituent in the process of combustion, is the form in which it is available. Hydrogen, driven off in the uncombined state and burned by mixing with the oxygen from the air supply, is a valuable factor in combustion, as it develops about four times the heat generated by an equal percentage of carbon. However, a certain percentage of the hydrogen is distilled from the bituminous matter in the form of tar vapor and water. The nature of these compounds has been ascertained when coal is subjected to destructive distillation, as in the manufacture of illuminating gas, but the transformation through which this portion of the hydrogen passes in the boiler furnace, is as yet undetermined. For the purpose of this discussion the theory of the code of the American Society of Mechanical Engineers, for conducting steam boiler trials, for the loss due to hydrogen, is accepted. This theory assumes that all hydrogen contained in the fuel, together with an equivolent amount of oxygen in the form of water, is raised from boiler room temperature, evaporated in the furnace, and superheated to the temperature of the escaping gases. The amount of heat thus lost depends upon the composition of the fuel, the temperature of the boiler room and the temperature of the escaping gases. In addition to the loss due to evaporating and superheating the moisture formed by the combustion of hydrogen and by the distillation of oxyhydrogen compounds, a small loss is incurred by heating the moisture in the fuel and in the air used for combustion.

Increasing interest in the economical operation of boiler plants has resulted in marked improvement. The distribution of heat in a plant operated with high efficiency before tests were made for contemplated improvement is shown in Table IV.

TABLE IV.—*Plant Operated with High Efficiency.*

	Original Conditions, Per Cent.	Tests to Improve Efficiency, Per Cent.	
1. Evaporating and superheating moisture in coal and moisture formed by the combustion of hydrogen and distillation of oxyhydrogen compounds.....	4.0	3.8	3.8
2. Heat carried away by the dry flue gases..	14.4	10.1	11.8
3. Heat escaping through the formation of carbon monoxide.....	0.9	1.3	0.4
4. Loss in combustible removed from ash pits and from grate during cleaning.....	0.6	0.8	0.9
Total determined losses.....	19.9	16.0	16.9
5. Other losses (assumed constant for all tests).....	8.0	8.0	8.0
6. Approximate percentage of heat absorbed by the boiler or boiler efficiency (by difference).....	72.1	76.0	75.1
Total.....	100.0	100.0	100.0

It had large units of Climax water tube boilers with circular grates fired through a number of doors. Considerable loss due to the formation of CO is shown, but this is more than balanced by the particularly small percent age of combustible removed from the ash pits and furnaces. The amount of combustible in this material averaged 12 to 15 per cent., representing a fuel loss of from 0.5 to 1 per cent. Although the operating conditions in this plant were excellent, greater care in firing effected an increase in boiler efficiency.

Removing Carbon from Gas Engines.

[From a Paper Read Before the National Gas Engine Association by MR. J. A. ANGLADA.]

About a year ago I tried running a 10-hp. stationary engine on denatured alcohol. This engine had been running for about a year on gasoline and showed marked evidence of faulty operation when fully loaded, although when first installed it had carried the same load without difficulty. In using denatured alcohol we started the engine on gasoline, running it until it became warm, when the gasoline was turned off and the carburetor connected to the alcohol supply. As expected, it was necessary to change the adjustment of the carburetor to permit a greater quantity of fuel to enter the engine, and when this was done the engine operated satisfactorily carrying without difficulty the load that caused it to misbehave when operated on gasoline.

An interesting thing was that the exhaust, which was clear when the engine was operated on gasoline, became black with smoke immediately upon change of fuel; and after a short period of running on alcohol the smoke disappeared, and there was showers of small discharged red sparks, incandescent particles of carbon, which were loosened from the walls of the combustion space by the alcohol.

It was found, on removing the cylinder head, that the top of the piston, the valves, and the walls of the combustion space, were covered with a layer of carbon which varied in thickness from 1/16 to ⅛ in.

When a steel scraper was used the deposit came off in the form of dust and small flakes. To continue the experiment the cylinder head was replaced and the engine operated under load with alcohol as fuel for 5 days of 8 hr. each, when the cylinder head was again removed, and nearly all of the carbon deposit had disappeared.

Carbon deposits on the surface of the combustion space of any type of engine must be avoided, because the radiation of heat from these surfaces is retarded, due to the relatively low conductivity of the deposit. It may cause spontaneous ignition, a common source of rapid depreciation of the working parts of an engine, in addition to affecting the economical and quiet operation. Spontaneous ignition (sometimes called pre-ignition,) is explained as follows: When the engine is in operation the temperature of the gases in the combustion space during the period of combustion is sufficiently high to raise the deposit to a red heat; the deposit retains the heat imparted to it in the power stroke, and serves to ignite the new charge of gas on the following compression stroke. The result then is that ignition and the consequent high explosive pressure, occur too early on the compression stroke, the force of the explosion tends to stop the engine and reverse its direction of rotation. The inertia of the fly wheel is generally sufficient to prevent this reversal, but all the powers transmitting parts of the engine are subject to undue stresses. This pre-ignition will in a short time cause the bearings of the connecting rod to fail and in many cases, the connecting rod or crank shaft is broken by the abnormal strain put upon it.

In high compression engines it is possible for pre-ignition to occur, from the increase of compression resulting from the decrease of compression space because of a thick deposit of carbon, which may not be at a sufficiently high temperature to ignite the charge. Carbon deposits frequently cause loss of compression by preventing proper closure of the valves if a small part of the deposit is loosened and lodges on the valve seat. Carbon deposits are the cause of greater wear of the working parts of an engine than appears at first thought. Just filter the oil drawn from the crank case of an engine and closely examine the substance extracted by a filter paper. It will be found that it is principally granular carbon which has worked past the piston rings and collected in the oil. If the engine is lubricated by splash feed or if the oil is used repeatedly without being thoroughly filtered, the carbon is carried to all of the working parts by the oil.

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NEW YORK, MONDAY, MAY 18, 1914.

THE MISSES CUNNINGHAM request that we express their appreciation of the many loving tributes and expressions of sympathy that have come to them, and for the lavish flood of remembrances sent their late brother, Thomas John Cunningham.

The staff of the JOURNAL join in this acknowledgment, and thank our many friends for their kindly letters and tributes.

[OFFICIAL ANNOUNCEMENT.]

Tenth Annual Meeting, Iowa District Gas Association.

IOWA DISTRICT GAS ASSOCIATION,
OFFICE OF THE SECRETARY,
DES MOINES, IA., April 18, 1914.

The tenth annual meeting of the Iowa District Gas Association will be held in Davenport, Ia., May 27th, 28th and 29th. The headquarters of the Association will be in the Kimball Hotel. Members are urgently requested to make early reservations. Mr. H. J. Carson, General Superintendent, Muscatine Lighting Company, is Chairman of the Committee on Arrangements, and will make reservations on request or furnish any other information desired. The following papers will be presented at the meeting:

"Circular 32 and the Report of Committee on Thermal Value and Candle Power made to the New York State Public Service Commission, Second District," by Mr. Austin Bush.

"Tar," by Mr. Alfred Hansen.
"The Storeroom," by Mr. Geo. G. Kuhn.
"Domestic Appliances," by Mr. C. W. Lockwood.
"The Elements of Gas Rate Making," by Mr. Henry I. Lea.
"Some Distribution Experiences," by Mr. W. H. Merritt.

The attention of the members of the Association is called particularly to this list of papers, which embody the most vital subjects before our industry to-day. In addition, the following standing committees will report: Manufacturing, Distribution, Construction, New Business and Public Relations. One whole day of the meeting will be held on board the Mississippi river steamer, "W. W." Other interesting entertainment features are being arranged.

G. I. VINCENT, Secretary.

[Special Editorial Correspondence, by Telegraph.]

ANNUAL MEETING, WISCONSIN GAS ASSOCIATION.

HOTEL PFISTER, MILWAUKEE, WIS.,
May 13, 1914.

The Thirteenth Annual Convention of the Wisconsin Gas Association was called to order at 10:30 this morning by President Ewald Haase, with Secretary Harman on duty at the recording desk. The regular order of business was set aside at once, in order to hear the lecture by Mr. B. F. Bart, on "Modern Methods of Manufacture of Steel Pipe," which was illustrated with motion pictures showing the processes from the ore pile to the finished product. Following this very instructive demonstration the President named as committee to nominate officers for the ensuing year, Messrs. W. C. Butterworth, F. L. Cross and Wm. Jones; and an adjournment was had for luncheon.

On convening for the afternoon session, Mr. Fischer, representing the Detroit Stove Works, showed films of "The Manufacture of Gas Ranges," giving the members a "moving" trip through the factory of the "Detroit Jewel." The first gas paper was that by Mr. J. C. Wilson, of Milwaukee, who described and illustrated with lantern slides, the "Large Quantity Measurement of Artificial Gases in Distributing Systems," which showed some things novel to most of his hearers, in the metering of gas. The next paper took up construction experience, and was that of Mr. C. R. Phenecie, of Green Bay, on "Some Points of Interest on High Pressure Gas Sub-marine Crossings." This was also illustrated, making all the papers of the day graphic presentations.

The Executive Committee reported the selection of Mr. R. B. Brown as the Association's delegate to the International Gas Congress in San Francisco; and the selection of Milwaukee, as usual, as the place of meeting in May, 1915. Twelve new members were recommended for election, and the report of the Secretary-Treasurer showed all the affairs of the Association in a healthy condition, including a cash balance of more than $1,100.

President Haase now delivered his address. He laid particular stress upon the need of closer affiliation with the National associations, and the simplification of association work generally, similar to the views expressed by Mr. W. H. Gartley, President of the American Gas Institute. Mr. Haase also called attention to the necessity of close watch upon all operating processes in the interest of conservation of material and effort, and pointed out the responsibility resting upon the gas fraternity in this connection. The special committee on the question of merging with the Wisconsin Electric Association reported recommending compliance only in so far as holding meetings at the same time and place, and with joint entertainment features. Action on this report will be had to-morrow. A Committee on President's Address was named, consisting of Messrs. E. G. Pratt, S. J. Glass and E. D. V. Dicky.

Report was made of the death of Mr. T. J. Cunningham, Editor of the AMERICAN GAS LIGHT JOURNAL, and by a rising vote the preparation of appropriate resolutions was referred to a special committee.

The banquet was royally enjoyed by the 114 in attendance. The Toastmaster was Judge J. G. Donnelly, and Messrs. Desmond, Gregory, Nivens and T. D. Miller were the speakers of the evening. —H. H. S.

HOTEL PFISTER, May 14, 1914.

The morning's session was started promptly with the address by Commissioner Halford Erickson on "Depreciation," whose exposition of the theory and application of this much discussed subject served to greatly clarify the matter for his listeners. Mr. D. G. Stroebel, of Fort Atkinson, then read his paper on "The Equipment of Domestic Science Schools," covering this growing source of business exhaustively and giving many valuable suggestions. The next paper was closely related, being that by Mr. J. H. Walker, of Milwaukee, which treated of "The Gas Appliance as an Educational Factor," and these too were naturally handled together in the broad discussion that followed them. Mr. R. O. Jasperson's paper on "An Intensive Water Heater Campaign," was supplemented by another by Mr. Guy F. Greeg, also of Milwaukee, giving their methods of handling and the excellent results from their efforts.

The report of the Nominating Committee recommended the following gentlemen as officers, and they were unanimously elected:

President, J. N. Walker, Milwaukee; Vice-President, C. R. Pheecie, Green Bay; Secretary-Treasurer, Henry Harman, Milwaukee; who make a combination it would be difficult to beat.

The Secretary reported that the registration showed 102 in attendance, a record figure for the Association. The report of the Committee on President's Address was received and adopted by acclamation. Yesterday's report by the Committee having in charge the matter of merging with the Wisconsin Electrical Association, was than considered, and the Executive Committee charged with the duty of working out the details of the joint meeting, etc., which was as far as the Wisconsin Gas Association elected to go in the matter. A very wise decision.

A resolution was moved and adopted, expressing the wish of the Association for closer and practical affiliation with the American Gas Institute, leaving the working out of the details of the relationship to the President and Directors of the Institute. Another resolution adopted provided that President W. H. Gartley, of the Institute, and President P. S. Young, of the National Commercial Gas Association, be advised that the Wisconsin Association looked with favor upon the proposed merging of those two National bodies, provided the work now done by each of them receives proper and adequate recognition in such consolidation.

The Committee to prepare a resolution on the death of Mr. Thomas J. Cunningham, presented its report, feelingly expressing the sentiments of the members of the Association, and it was adopted by a rising vote. Mr. S. J. Glass was re-elected as the Wisconsin Gas Association's representative on the Board of Directors of the American Gas Institute, and after completing the routine matters of the convention, adjournment was declared.

Altogether the sesssions have shown well sustained interest.—H. H. S.

BRIEFLY TOLD.

Compressed Gas Moved by Motor Cars.—Apropos of the suggestion made by Mr. James Ferrier in his presidential address to the Southern Gas Association in Mobile, which appears in full on page 315 of this issue of the Journal, is this note of foreign practice:

"At Ollen, in Switzerland, they have found it worth while to provide a 60-horse power motor wagon for carrying 9 cylinders of gas compressed to 30 atmospheres to the neighboring small town of Aarburg, in order to fill the holder there. The cylinders are lifted off the wagon and the motor car is then used for other transport services."

Evidently some one else has had Mr. Ferrier's idea brought to them by a local problem.

A Change in Engineering Education.—Columbia University announces a change in the conditions for admission to its engineering schools, by which candidates will be required to present evidence of preparation in general educational subjects equivalent to 3 years study in the regular college course. Such procedure has already been adopted at Harvard and is similar to German custom. This is what is required of candidates for law and medicine, and is a recognition of engineering as a profession of the same dignity as the law and medicine, and as requiring much the same educational foundation. With the splendid facilities offered by Columbia this raising of the standard will give them an engineering school of as high a rank as any in the world. At Harvard the graduates receive the title of Doctor of Engineering.

Allied Gas and Electric Companies of New York Occupy New Building Together.—The New York Edison Company, the United Electric Light & Power Company, the New Amsterdam Gas Company, the Standard Gas Light Company and the holding corporation, the Consolidated Gas Company of New York, are now occupying the latter's new 17-story building at 130 East 15th street, New York. It is obvious that the grouping of these allied companies under one roof will prove decidedly advantageous for economic reasons. There is an auditorium in the building, where lectures and discussions will be held, classes in public safety service betterment will be conducted, and the various company commercial and technical sessions will meet.

Object to Trust Bill.—Counsel representing some utilities companies and interested banking houses, appeared before the Senate Committee on Interstate Commerce, last week in criticism of the Senate draft of the Trust Bill, urging that public utilities should be exempt from the bill's inhibitions against holding companies. The public utility, they said, was already carefully watched by State officials, and even through mergers, could work no harm. The bill, they argued, would cause a tremendous financial upheavel in the control of public utilities, if enacted without amendment. If holding companies of public utilities should be held to be engaged in interstate commmerce, the effect might be to prevent such a company from acquiring or holding the controlling interest in the gas and electric plants in a particular locality, even though the State Commission permitted it. Congress only wants to eradicate evils, and does not wish to injure or prohibit such holding companies as serve a useful purpose, and do not lessen or prevent competition between corporations which are or should be competitive. Of the $2,000,000,000 capital invested in electric light and power companies, 76 per cent. is controlled by holding companies. Of the $1,333,000,000 in artificial gas companies, approximately two-thirds is controlled by holding companies. Street and interurban railway companies represent a total capital of approximately $5,000,000,000, of which two-thirds is controlled by holding companies.

Brooklyn, N. Y., Engineers' Club.—At the regular monthly meeting of the Brooklyn Engineers' Club on Thursday last the paper presented was by Mr. L. S. Stiles, Constructing Engineer, Brooklyn Union Gas Company, on "Gas Engines as Prime Movers for Power and Electric Stations, and their Application to the Modern Gas Pumping Station." Mr. Stiles described the new 10 million cubic foot holder of the Newtown Gas Company at Elmhurst, giving details of its construction; and the gas pumping station also located there, giving in detail the reasons for selecting gas power for the station, and the very elaborate tests made on the performance of the engines. He used some 70 slides in illustrating his remarks, and the interest aroused by his paper was indicated by the very good discussion that followed.

As a Means of Obtaining Efficiency.—At a recent conference in New York city, at which were discussed ways of selecting and training employees, one of the speakers dwelt particularly upon the obligations of the employer and the effect of his bearing and personality. He said that, "Harmony between man and boss depends upon the proportion and nature of the positive and negative elements of character of each. An extremely positive boss will not work harmoniously with either extremely positive or extremely negative men—and conversely. As to disposition, there are several types of executives, two of which, very commonly met, may be analyzed as follows:

Positive—or Driving.	Negative—or Drawing.
Keen.	Mild.
Quick.	Deliberate.
Domineering.	Persuasive.
Changeable.	Constant.
Impatient.	Patient.
Opinionated.	Teachable.
Excitable.	Calm.

The positive, driving type, if given men of his own degree of positiveness, will arouse antagonism and insubordination. The negative type, if given men of his own disposition, will fail to arouse enthusiasm and stimulate action. Give the positive boss men several degrees more negative than himself, and the negative boss men several degrees more positive than himself, and the result is harmony. Educate the boss, in addition, to apply the principles of efficiency to the job and the principle of character analysis to his men, and the problems of management are solved. This is the ideal."

Co-operative Investment.—All the employees of the Consolidated Gas Company of New York, and of the Edison Company, are to be enabled to become stockholders in the Consolidated Company. Plans are being formulated for an employee's investment company, and those joining will have the amounts they may wish to invest deducted from their weekly pay, to be used for buying Consolidated stock upon the Exchange. There seems to be a genuine desire on the part of the employees to become financially interested in the company that employs them, and there is no doubt that the scheme will be sufficiently supported to make it as great a success as the Building and Loan Association for employees already in existance.

Efficient Adminstration of the Operating Department as an Aid to New Business.

[Read by Mr. John A. Clark, Jr., before New Jersey State Gas Association.]

Our industry can be compared with a factory which manufactures an article for universal use. We are subjected to competition and the extent to which our product is sold depends largely upon the efficiency of our organization. We have divided our organization into departments in order that certain groups can specialize and develope the various lines of work to a greater degree; the number of separate departments depending somewhat upon the size of the Company, but they are usually four, viz: Manufacturing, Distributing, Commercial and New Business.

The Manufacturing, Distributing and Commercial form the operating departments leaving the new business department or selling end of the business by itself. The subject for discussion today is to what extent does the efficiency of the New Business Department depend upon the work done by the operators.

Unfortunately, there is no method by which we can measure the results obtained by our individual efforts. We throw all of our labor into a common melting pot from which the dross of expenditure is separated from our gross receipts, and the dividends which remain cannot be easily traced to the material supplied by any particular group of individuals.

The manufacturing department supplies the goods and furnishes the foundation for us to build upon. This department has been developed to such a degree and the gas they supply is so invariably above the standard of quality of heat units and candle power, that some of us occasionally lose sight of their importance; but let them fail to deliver us good gas for one day and we are thrown into confusion, while, if they should continue to serve bad goods for an extended period, all the intelligence, skill and energy of the new business department could not increase our consumption.

The distributing department take the gas from the works and delivers it to the customer. It also supplies him with service in order that the gas may be easily obtainable and its use more attractive. Great attention has been paid to manufacturing details, and the mechanical features of distribution have received considerable attention, but the delivery of service is a detail which can still stand improvement.

That an efficient distribution department aids the new business Department to a large extent cannot be questioned. We are selling gas and service. If we cannot deliver good service the people don't want us, and it is a great handicap to any salesman not to have the goods delivered satisfactorily to his customer. To show to what extent good mechanical work can aid the salesman and sales' department, I wish to cite as an example an actual occurrence. A suburban town was about to have gas laid through its principal streets. It was strictly a residential district inhabited mostly by commuters and the fine lawns in front of their houses were a source of individual pride.

A preliminary canvass was made early in the summer and a large percentage of the people refused to sign a service application fearing that their lawns would be injured. They had, fresh in their minds, the work done by the new municipal water department and did not care for any more ditches. They preferred to wait until winter or else not have gas at all. The gas company had an excellent service gang on the job who laid down canvass to prevent the dirt getting on the grass, preserved the top soil, and restored the sod so carefully that the following day no trace of the ditch was visible. This good work attracted attention and soon the applications began to come in, and before July 1st, 90 per cent. of the houses in this territory were using gas ranges. The faithful laborers scored a decided hit with the people, and the salesman's efficiency was increased two fold by this good service. Later in the season, when the question of using gas for light was being discussed, the salesman found it difficult to obtain house piping orders because the prospects feared that their floors and walls would be damaged. By this time, however, the company had well proven its ability to do good work, and after they had done a few first-class jobs, this objection was forgotten.

As previously stated, the mechanical end of the operating department has been well discussed. Volumes have been written describing the details, from, how to operate a water gas set to the shape of the shovel best adapted for street use. I believe, however, that our shop department has not received quite enough attention, and as a result has fallen to the rear of the procession.

It is the fitter who can give the new business department the greatest aid. (In this paper the word fitter is intended to include the entire shop department of journeymen, inspectors, dispatch clerks, etc). The fitter can be of assistance to the salesman in the following ways:

A. By answering the consumer's complaint properly and promptly.

B. His intimate knowledge of gas burning equipment makes him an authority on this subject, and his advice to the public as to the proper appliances needed for specific purposes constitutes a desirable service.

C. When, for any reason, the consumer changes his mind between the time the canvasser takes the order and the workman arrives on the job to do the work, an intelligent fitter should be able to prevent a cancellation and resell the goods rather than return with them to the storeroom.

D. While the fitter is on the consumer's premises, engaged in installing an appliance, he is often able to gain their confidence and pave the way for future sales.

E. His ingenuity in correcting the defects of poorly designed apparatus often turns defeat into victory for the salesman.

F. When reviewing plans for new buildings, he is able to recommend the installation of appliances, and as he is considered a practical man, his advice is given much weight, and many profitable sales result from this source.

G. The Canvasser is often so enthusiastic that he makes sales which are against the consumer's interest. The fitter should act as a check in such cases and keep the salesman out of trouble.

H. By his general intelligence, skill, courtesy, tact and willingness to oblige, he obtains the good will of the public, thus opening the door to the salesman.

An order from the consumer is first given to a salesman, then received by a clerk, passed on by the new business manager, accepted by the credit department, and copied by a stenographer before the fitter is called upon to do the work. The fitter is then expected to untangle all the errors and omissions of those handling the order before him, to perform the mechanical duties requiring the intimate knowledge of at least three separate trades, explain the operation of the device purchased in a courteous and intelligent manner and leave the consumer satisfied. For the benefit of the consumer he works nights, holidays and Sundays in order that the factory may have new gas installation without interfering with their daily operations. From a day spent in the heated cellar connecting an appliance, he is sent out into the cold and snow in order that frozen service and risers may be cleared and leaks repaired. And, on top of this, he receives many unjust complaints from the fault-finding public which come, as they sometimes do, first to an official of the company, then to various department heads until at last it is served to the fitter garnished with threats and flavored with tobasco. Yet, in spite of the important position which our fitters occupy, in spite of the difficulties which surround him in the execution of his duties, we have done little to improve his efficiency. After fifteen years' experience in distribution work I regret to state that the average fitter to-day does not compare favorably with those I found on the job when I began my career.

As I said before, we have developed the production and delivery departments to a remarkable degree. The sales department has been built up so as to obtain wonderful results, but the individual upon whom we depend to give the good service, which goes with our gas, has been allowed to stand still. What can be done to improve this condition? I recommend:

1. That great care be used in selecting the men. It takes several years to make one competent, and unless you start with good material, much of the time spent training him will be wasted.
2. Educate. Along this line we need the best thought of the members of this and similar organizations. The N. C. G. A. School for salesmen has proved a good thing and a similar course for the fitter is recommended.
3. Show a greater appreciation of his value.

In closing, I trust that the discussion to follow this paper will bring out other methods of improving the efficiency of our shop department. The commercial department has its own field to cover, its own work to do, and the manner in which they perform their duties has a direct bearing upon the results obtained in the new business department. However, as I am not associated with this line of work, I leave its discussion to a future paper.

We are all working with a common object in view. The success of

the company means departmental and individual success, and the best results are obtained when we adopt the slogan of the three guardsmen, "One for all and all for one."

Address of the President (Mr. James Ferrier) of the Southern Gas Association, Mobile, Ala.

Gentlemen: The year that has elapsed since our last meeting has witnessed many changes, political, social and industrial, which cannot fail to affect business in all its branches, including our own. It has witnessed a reversal of long established government policies which probably have a less direct bearing on our industry than on most others, but which cannot fail to be felt as business adjusts itself to its new environment.

The year has developed a welcome change in the mutual attitude of corporations and the public, or the government that represents the public. The Star of Reason seems happily to be on the ascendant and a long deceived public is realizing that what La Fontaine taught regarding the flatterer is equally true of the demagogue and the muckraker, to-wit: That they each and all live at the expense of those who listen to them.

Forecasting, if I may so venture, the effects that these political and social changes may have on us—it is possible that the lowering of the tariff may affect structural costs, should replacement values have to be determined, although the large proportion of such costs represented by labor should make the changes unimportant, if indeed strict justice towards the companies should permit any.

We may look for an increase in the number of State Public Service Commissions—and these we should welcome rather than otherwise, constituting as they do, or should do, permanent and unbiased boards of arbitration. One addition that I do hope to see made to the powers of these commissions, is the supervision of municipalities who assume the functions of public service corporations. I can see neither common sense nor justice in municipalities being exempted from any of the duties or burdens which are supposed to be justly borne by companies. I speak more particularly of taxation, but there are other matters in which a demand to "toe the mark" is just as reasonable when applied to municipalities as to companies. I hope that this association will fight both jointly and severally for such powers to be granted to Public Service Commissions and the unjust exemptions now enjoyed by municipalities brought under regulation.

But the business and the policies of gas companies are far more likely to be shaped by the present trend of industrial development than by the action of bodies of quasi political character. A nation wide movement for conservation and efficiency has started. Combining the two terms, it means a demand for the abatement of of waste, whether of energy, or the sources of energy, such as fuel. The most noticeable effect of this movement up to now, has been the rapid development of hydro electric power, with the promise that other developments will follow, such as the generation of electric energy at coal mines and the practical disappearance of the "black diamond," and with it gas possibly as an article of commerce. Indeed, since these lines were penned, I see it stated that a South African coal mine has decided to adopt this method of disposing of its product.

How far are such developments likely to go, what effect are they having and will have on the gas industry, and what should be the policies of our gas companies in view of them? When I speak of our gas companies, I refer particularly to those represented in this Association, and remember that the answers to these questions that I will try to give are my personal views, and not ex cathedra pronouncements.

In comparing gas with electric current, I think heat, or the capacity of producing heat, a fair criterion of valued delivery. Adopting this as a standard, some interesting facts are revealed. A kilowatt hour of electricity is capable of producing 3,411 B.T.U's. A horse power is equivalent to 2,545 B.T.U's. Taking a fairly representative gas at 600 B.T.U's per cubic foot, we see that less than 6 cubic feet of gas have more of heating value than one kilowatt hour of current, and that it would have to be sold to the consumer at less than 6 mills per kilowatt hour to compete as regards heat value, with gas at $1 per 1,000. The disparity is great, but other factors come in, especially the amount utilized, which I will consider later, but understand, I am not giving these figures with the intention of producing a complacent feeling of security.

A hydro-electric plant being developed in North Georgia, promises to deliver 90,000 horse power of energy. Such figures I have found in many instances to be gravely exaggerated, but assuming the figure correct and that there will be no transmission or transformed losses, the heat value of the 90,000 horse power operated for 24 hours per diem is equal in round numbers to 190 tons of fairly good coal, or 9,000,000 cubic feet of fairly good gas. Place along side these figures the fact that one industrial establishment in this country is now demanding 2,000,000 feet of gas per day, and draw your own conclusions.

Coming to the consideration of coal mines selling their product in the form of electric energy, we are confronted at the outset with the fact that were the coal used in the cheapest form of gas in internal combustion engines at the unusual efficiency of 40 per cent., we have here an initial loss of 60 per cent., allowing nothing for losses in generation, transmission and transformation. Remembering that a ton of coal represents 29,000,000 heat units, a very simple calculation convinces us that much the cheapest mode of transporting heat is still the old despised coal car. Do I give you the impression that my belief is that coal is destined to be used as at present, i. e., in its raw state? If so, I am gravely misleading you as to my view. My belief is that the days of using coal in its raw state are almost numbered. I am not here as a defender of the business methods of the Standard Oil Company, but I unhesitatingly say that they have given an object lesson to the country in demonstrating what can be done by taking a raw product, applying science to its manipulation and finding markets for the products. It is stated that the profits of the various companies represented by that combination last year, amounted to $78,000,000. That is 8½ per cent. on the combined capitalization of all the gas companies in this country given in last census at $915,000,000. Can coal be treated in like manner as crude oil? I answer yes. But in connection with what I have said as to the transportation of the raw article, it seems the better business proposition to establish those coal refineries, if I may so term them, in populous and agricultural centers. There can be found markets for the various grades of smokeless fuel which cities are now demanding, for the gas, for the hydro carbons, for the pitch, for the ammonia, for the cyanides, for the sulphur. Beginnings have already been made in such establishments, such as recovery coke ovens, but the prime product of most of them has been metallurgical fuel, a business liable to serious fluctuations in the course of trade, and seemingly little has been done by such establishments themselves in working up the by-products and creating markets for them. In my opinion the clamor for smoke abatement in cities, together with the monopoly now existing in the anthracite coal fields, will stimulate a demand for smokeless household fuels and lead to the establishment of coal distilleries not wholly dependent on the metallurgical end of the business. We have already seen a commencement of this in England in the production of coalite and carbonite, and although commercial success has not yet attended these efforts, I can see no reason for regarding the attempt as doomed to ultimate failure. The probable effect of such a revolution in the treatment of coal would be the sale of gas at wholesale to existing companies, and in this it would be to some extent progressing on the same lines as the hydro-electric development that we are now witnessing. Already I have heard of an important reduction in price contemplated by a Southern Company in consequence of its obtaining its supply from a coke oven plant. Our duty is to welcome all such developments, knowing that whatever enables prices to be reduced brings us nearer the bed rock of security. I have been giving you a vision of the future, as I see it, considering present tendencies. It may be some way off, but it is a state of affairs that I think gas companies may expect and prepare for. I can hear you say that these visions are all very well, but the grim present is what we have to deal with. You are right, the supreme question is what should we do now? In common with all public service corporations, we are experiencing an increase in all branches of operating expense. Interest, labor, material, taxes, all are advancing. Railroads are seeking relief by a demand for increased rates. Should we do likewise? On the contrary, I think the present situation calls for efforts on our part to (1) reduce the cost of gas; (2) to put more efficient appliances into the hands of our customers; in other words, to see that they get more benefit out of what we sell them. On the first of these proposition—to reduce the cost of gas, it is with extreme diffidence that I say anything, knowing well that each company is to a great extent a law unto itself as to how it can be done. Unfortunately, few of our small companies are models of efficiency when that means making the most of what is in coal.

Very valuable compounds are wasted mainly for the very good reason that it is not profitable to work them up on a small scale. Increased efficiency can come only by increased sales of gas and the capital expenditure necessary to secure such increased sales has been a matter for serious consideration by many companies during these times of monetary stringency. One method, however, of securing such increases at a moderate capital expenditure has occupied my thoughts for some time, although to some it may appear chimerical. Most of us have within 20 to 30 miles of our works, comparatively populous centers, and most of them are hungry for gas, and would willingly grant the required franchises. Many of them, I believe, would also furnish the greater part of the capital necessary to install a distributing plant. Could not these be supplied from existing works thereby greatly increasing their sales? I know that this with many will at once bring up the vision of the pipe lines, with capital expenditures and expensive maintenance calculated to stop consideration at the outset. But how many of us know that gas is now being transported hundreds of miles without pipe lines? I mean the compression system used for Pintach gas. Can what is being done on a small scale be done on a large one? I believe it can, and so far as I have figured the capital expenditures necessary with compression tanks as compared with pipe lines, the comparison is almost rediculously in favor of the former. A tank 8 feet diameter and 40 feet long would transport 30,000 cubic feet of gas compressed to 15 atmospheres, and would weigh only 1,226 pounds more than when full of air at atmospheric pressure. Of course, the minimum weight rule of the railroads would come into play, and indeed the uncertain factor in the scheme is transportation charges. But let us remember that there are in sight, if not in existence, good roads that may render transportation independent of railroads, if they should prove unreasonable, especially in view of the fact that the car carries the wherewithal for its motive power. The subject of compression brings up the possibility that science may probably find solvents that will materially assist that process, as the compression of acetylene is aided by the presence of acetone. I cannot say that the idea of distributing gas in this manner is altogether original with me. I first discussed it with Mr. Robb, sometime manager at Chattanooga, and well acquainted with the Pintsch gas business, and it is now put before you for what it may be worth.

Considering the second proposition—that we must obtain more efficient appliances. I had expected a paper dealing with that subject, but I admit that it is a large one and that many factors must be considered. More than a year ago I saw the statement that a German investigator found the efficiency of electric cooking stoves to be 70, while that of the best gas stoves was 50. We need not believe that our electric friends will be content with 70, and we will not be true to our business if we remain content with 50. We owe it to our customers as well as to ourselves to select only the most efficient appliances. In this regard, I look for much from surface or flameless combustion. The idea is not new, although the development has been recent. Many years ago, Fletcher, of Warrington, England, demonstrated the fact that when a mixture of gas and air in the combining proportions was projected on a hot surface, immediate oxidation to CO_2 and H_2O took place, and the heat being generated in a comparatively limited space, gave very high temperature. As a matter of fact, flame is an evidence of slow and gradual combustion, the constituents of the gas being broken down from more to less complex compounds before final combustion ensues. Of course this spreads the heat of combustion over an extended space, and produces a much lower temperature than when combustion is immediate. Note the fact that the great advantage possessed by electricity is not the quantity of heat delivered, but the production of that heat within a very limited space. A year ago, in a paper, I pointed out that the energy used in operating a 2,000 C. P. nominal electric light could be secured from between 2 and 3 feet per hour of gas. I look for surface combustion to be utilized more especially in the industrial end of our business, but I feel obliged to say that manufacturers of gas motors seem to be deficient in either ingenuity or enterprise, in that they do not produce a motor to supply the air pressure. Surely, if a 50-horse power gas motor can be made to occupy such small space in an automobile, it would seem possible to produce a ½ to 1-horse power motor to produce surface combustion and render the proposition, all gas if you please. In gas appliances now in common use, much can be gained by a careful study of the process of combustion, and careful workmanship in the construction. Several years ago a new incandescent burner was put on the market, the construction of which appeared to be eminently correct as far as scientific principles was concerned, but which proved an utter failure, due, in my opinion, to careless workmanship and assembling. The orifices in all appliances should be drilled with the utmost care, at the proper angles and with no rays or rough surfaces left. It should be such that the jet of gas is fairly in the center of the mixing tube. The mixing tube itself would be better were it smooth as a gun barrel, and the orifices in the burner should be so proportioned as to cause no back pressure, and thereby prevent the entraining of the necessary proportion of air. I believe that I please rather than offend our appliance manufacturers here represented when I advise all our managers to exercise the utmost caution in selecting the appliances they intend placing in the homes of their customers.

If I have presumed to talk to you gentlemen in the language of a seer, the only excuse I can offer is that I am voicing impressions produced by observation and experience, and that the expression of conviction, even if erroneous, is the best way of eliciting the truth regarding our business, which, after all, is the prime object of this Association.

Some interesting papers are on our programme. I am sure that a thorough and trenchant discussion of them is the best way of showing our appreciation of the author's labors and of rendering our meeting instructive.

Some Present Street Lighting Problems.[1]

By J. R. Cravath.

The scientific study of the production of satisfactory interior illumination has progressed much more rapidly than that of street lighting, and certain features of the latter are very much in need of investigation on a more scientific basis than has yet been attempted.

One of the principal problems involved is that relating to the question of large versus small units. It is important to know how far it is desirable to go in reducing the size and shortening the distance between lamps. The relative cost of a given quantity of light delivered from large as against small units, of course, has an important bearing on the ultimate solution of the problem. However, before any such ultimate solution can be reached in any case it is necessary to know the relative practical illumination values to the user of the street of the various possible arrangements of large and small units from a purely illumination standpoint, leaving out of account the cost of production.

For many years exclusive use was made of large and efficient light units such as the arc lamp on the one hand and the much less efficient small incandescent unit on the other. Recently the old limitations have been removed, and their removal opens up an unexplored field in the production of street lighting effects. Thanks to the tungsten lamp, a large range of sizes of efficient lamps exists, and the methods have been perfected for more economically distributing electrical energy to small units than formerly where underground service is required. There is now an abundance of new tools, but one does not know yet how best to use them. One cannot say with certainty, for the lighting of any given length of street with a given amount of light flux available, what sizes of lamps and spacing will give the best illuminating effect. It is probably safe to state that a majority of the leaders in the field of illumination would have been much more certain of the correct answer to a problem of this kind several years ago than they are at the present time, some of the most important considerations in street lighting usually not having had sufficient weight in years past. In 1910 Mr. Preston S. Millar, in a paper read at the Illuminating Engineering Society Convention, called attention to some neglected considerations pertaining to street illumination, and since then one has come to realize adequately how much one's seeing along streets at night is attributable to the silhouette effect. In other words, pedestrians and vehicles are seen very largely because they are silhouetted as dark objects against a lighter background which reflects the light from the lamps along the street. Even in the best lighted thoroughfares the silhouette effect is very important, while it constitutes about the only method of distinguishing objects along the greater portion of the more dimly lighted streets.

It is easy to determine the probable intensity of illumination on a street or sidewalk surface from given sizes and spacings of lamps, and the probable surface brightness of different portions of the street can be arrived at by calculation after a sufficient number of tests have been made on the diffuse reflecting power of the street surface.

1. *Electrical World.*

From this, one might suppose that it is a simple matter to calculate theoretically the street surface brightness resulting from different sizes and spacings of lamps and so to determine their relative value in producing the desired silhouette effect, just as one can calculate theoretically the amount of illumination on vertical objects. For many years the vertical illumination was the only one that received consideration from many engineers. Much of the value of the calculations of street surface brightness, however, is uncertain because of the fact that in viewing any vertical object along the street it is seen silhouetted against a background of street which may cover a considerable distance ahead and probably consists of alternate patches of light and dark pavement.

The question that arises is, can an object be seen better against a uniformily illuminated background, such as would be obtained with small lamps at frequent intervals, or with a back ground much less uniform, with occasional spots much brighter than in the first case, such as would be obtained by an equal total flux of light from lamps spaced at longer intervals? The effect on the eye of the street user produced by these different sizes and spacings of lamps, cannot be calculated theoretically from information now available. The effect is both physiological and psychological. The only way to determine these uncertain factors is by making an actual test on the street, in such a way that different arrangements can be compared directly. For this purpose similar converging streets would have to be equipped with lamps for a distance of from ¼ mile to ½ mile from their convergence. The light flux per foot of street should be the same in all cases, if results of real value are to be obtained. In such experiments it is necessary that the streets under comparative test converge, so as to admit of quick and easy comparisons, since it is a notorious fact the eye has no memory so far as illumination values are concerned. After the fundamental requirements are determined in this manner, the light flux per foot of street could be so varied as to present for direct comparison different systems of equal annual cost per foot of street illumination.

Certain extreme conditions are not in need of investigation, because they have already been used many times and are matters of common casual observation. For example, it is well known that large units, such as arc lamps, spaced from 600 feet to 1,000 feet, as in hundreds of small towns, do not provide satisfactory street illumination. An equal amount of light flux, small though it may be, scattered along the street from small units, is known to be more satisfactory. One does not know, however (for the reasons before explained), how far it is desirable to go in reducing the size of the lamp and shortening the spacing.

For the reason mentioned before, it is believed that street lighting cannot be judged either by the average or by the minimum illumination, midway between lamps alone. Perhaps a low minimum illumination may be compensated for, partially by the bright background afforded by the greater illumination under each lamp, if the intervals between the lamps is not too great.

Considerable discussion has taken place in England on standard specifications for street lighting, proposed by Mr. A. P. Trotter, in 1913. These specifications, in brief, were that the minimum horizontal illumination at any point along the illuminated street, should be taken as the basis of contract. Strong exceptions were taken to this proposed specification, in the lengthly discussion on it, in the (British) Illuminating Engineering Society, and the defects of the proposed plan pointed out.

In view of the importance of silhouette effects in street lighting it is very improbable that good street lighting can be judged by minimum values alone. While it is known that brightly lighted areas under large lamps produce light backgrounds which are of decided assistance both in the apparent and in the effective illumination of the street, it is known, on the other hand, that if these lamps are far enough apart a point is reached where the extreme contrast between these brightly lighted areas under the lamps and the dark areas between lamps tends to confusion and interference with vision. The fundamental problem is to determine how far the average illumination along the street can be raised above the minimum illumination at the darker parts before the detrimental effect of too much contrast overbalances the helpful effects of the better illuminated patches of background which the higher average of illumination will give. An other question which could profitably be investigated in the course of such experiment, would be the proper height of lamps with different spacings of lamp-posts. Usually the height is limited in residential streets by trees, but in streets where there is no such limitations, this question needs further study. It is well established that glare from street lamps interfere with or reduces the ability to see with a given illumination of the street surface. The actual effect on the street, with different lamp heights, can be determined only by actual street experiments, where just comparisons can be made simultaneously, or nearly so, by a number of observers, technical and non-technical.

A third point for fruitful experiment is that of shades and reflectors for street lamps, which will minimize the glare effect of distant lamps without restricting too much the area illuminated by one lamp.

In view of the increasing amount of money spent annually for street lighting, the expense of such tests (although considerable if properly carried out) would be amply justified, since an immense amount of money will be wasted during the next few years, through the ineffectiveness of street lighting, unless some of these fundamental determinations are made.

The Liquid Contraction of Cast Iron.

Investigations have been made to solve, if possible, the reason why gray iron castings contain subcutaneous cavities, a source of great trouble, inasmuch as frequently a casting, when machined, is apparently sound, but when subjected to a hydraulic test is found to be leaky. Longmuir originated the term "liquid contraction" to distinguish the local contraction which takes place in the heavy part of a casting when the outside skin has solidified. Solid contraction also known as shrinkage is the natural contraction which metals undergo when passing from the hot to the cold condition. These two forms of contraction are closely related as regards occurrence and extent, and conditions which conduce to maximum or minimum solid contraction similarly effect liquid contraction.

Most foundrymen agree that castings run with "dull" or "cold" iron do not so readily "sink" or "draw" as when the metal is run hot. However, while "sinking" and "drawing" may be reduced to a minimum by pouring with dull iron, liquid contraction is reduced to a minimum by pouring iron as hot as possible without actually boiling it. From tests at various temperatures and under selected conditions it was concluded that:

1. Liquid contraction is accompanied by a lowering of the specific gravity or density.

2. Casting temperature is one of the ruling factors in obtaining a dense and solid casting, and therefore also affects the liability to liquid contraction.

3. When castings have been cast with iron hotter than will conduce to liquid contraction, solid and dense castings result; when cast with iron too cold to conduce to liquid contraction, blowholes appear. Hence the series of conditions is: Cast hot gives dense castings; medium heat, liquid contraction; cold iron, blowholes.

4. The more regular the sizes of the microscopical constituents the less will be the liquid contraction.

5. Conditions which conduce to a maximum solid contraction conduce to a maximum liquid contraction.

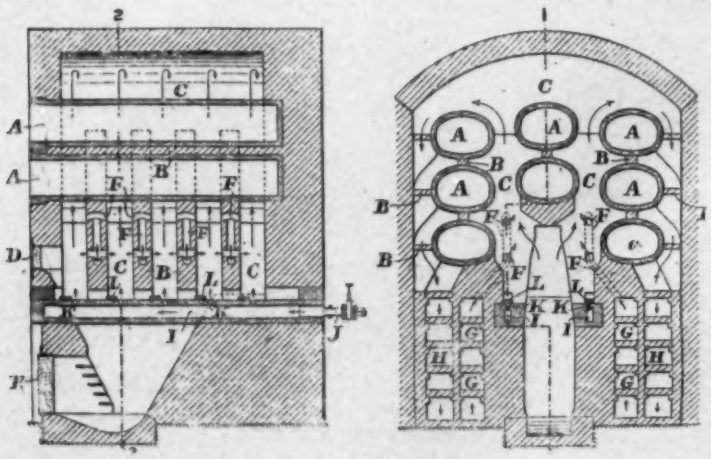
6. Gases appear to be held in more intimate contact in cast iron poured at a high temperature, and therefore tend to produce a more solid and dense casting.

The research has dealt with iron of the better variety as being the most liable to be affected, and giving the greater worry and loss to the manufacturer in rejected castings.

New Methods and Appliances.

RETORT-SETTING FOR VARYING OUTPUT.—The Stettiner Chamotte Fabrik Actiengesellschaft has taken out a French patent for a generator retort-setting, which can be kept working continuously, notwithstanding variations in gas consumption at different periods of the year; thereby, it is claimed, ensuing profitable return on the capital invested and a constant production of coke.

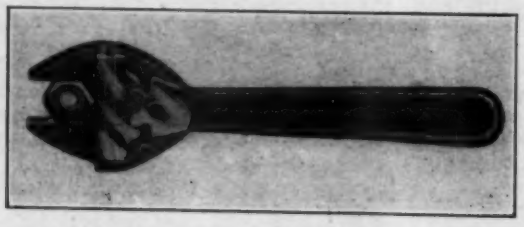
Fig 1 is a longitudinal section on the line 1 of Fig. 2, which is a transverse section on the line 2 of Fig. 1. The setting represented has horrizontal retorts, *A*, supported by wall, *B*. Under the retorts is a generator, with a stepped grate and fireplace, connected with the combustion chamber, *C*, surrrounding the retorts. The generator is fed with fuel through opening, *D*, and the clinker and ash are removed at *E*. The air for combustion enters the chamber *C* from the channels *F*, which communicate with the passages *G* of the recuperators on each side of the generator. The walls *B* are so made that the combustion gases ascend in the direction of the arrows, between the middle and side groups of retorts, and down through the



passages *H* of the recuperators, effecting a preliminary heating of the air of combustion in the passages *G*. In the top of the side walls of the generator are horizontal gas intake passages, *I*, connected with a supply of illuminating gas, *J*. The latter passages, governed by valves, are used to convey into the setting part of the gas made. The passages *I* communicate with the chamber *C*, through the openings *K*, which are regulated by dampers *L*.

When there is a large demand for lighting gas the generator is utilized to heat the setting and the valves and the dampers are shut, and all lighting gas is conveyed into the distribution plant. In the summer, when the consumption falls off, the generator is thrown out of action. The openings *D E* (shown by the broken hatchings in Fig. 1) are walled up; the valves of the passages *J* are opened, and the dampers *L* regulated as required. The setting is then worked so that 50 to 60 per cent. of the lighting gas is conveyed to the chamber *C*, to burn with the air, entering through the passages *F*, and heats the retorts. Consequently the setting need not be stopped, and the production of coke is not interrupted. When the consumption increases again the valves *J* are closed, and after removing the masonry, the generator is fired to heat the setting.

Automatic Self-Adjusting Wrench.—An automatic and self-adjusting wrench, the ratchet principle of which is apparent from the illustration, is being manufactured by a western company. The



manner in which one end of the wrench handle is formed as a pinion, the handle being pivoted and acting as a lever and the pinion driving a rack which is integral with the adjustable jaws, is such that the act of pulling the handle tightens the wrench on the nut and when tight turns the nut. Pulling the handle in the opposite direction releases the wrench. To unloosen the nut the wrench only requires to be turned over and applied in similar manner.

The wrench is simple in construction, consisting of but three pieces, and is made from drop forgings. It can be furnished with an adjustment adaptable to sizes from ¼ to ¾ inch.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,094,466. Gas Washer. W. B. Osborne, Sewickley, Pa., assignor to Riter Conley Mfg. Co., Pittsburgh, Pa.

1,094,762. Gas Generator. L. Van Vliet and F. O'Neil, Pomona, Cal.

1,094,832. Automatic Gas Valve. C. Bargamin, New Haven, Conn., assignor to Sentinel Automatic Gas Appliance Co., same place.

1,094,897. Gas Producer. J. H. Hirt, El Paso, Tex., assignor, by direct and mesne assignments, to Allis-Chalmers Mfg. Co.

Items of Interest
FROM VARIOUS LOCALITIES.

The Easton Gas Works has recently completed extensive improvements and additions to its generating plant at Easton, Pa., which, it is expected, will increase the efficiency of the plant about 40 per cent. The capacity of the plant is now 1,200,000 cubic feet of gas daily, and it is said to be one of the best in the State. The most important part of the generating apparatus is in duplicate, insuring certainty of operation in any emergency. Supt. Holzer has done excellent work.

"M. A. N.," writing from Barnegat, N. J., under date of May 4th, says: Longer days and shorter nights along the shore have been made possible in the quaint old village of Barnegat, N. J., which is now nicely lighted with gas street lamps, installed by the Ocean County Gas Company, which supplies this shore territory by high pressure from their plant at Toms River, N. J. This goes to show that the march of progress goes merrily onward in the remote places as well as the larger cities, and still further proves that gas plus a little hard work from the bunch makes many things possible. The Ocean County Gas Company is enlarging its plant to double former capacity, and Superintendent McClary will get the business for it,

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The J. G. White Engineering Corporation has been retaincd by The Capital Traction Company, of Washington, D. C., to make a complete inventory and valuation of their property. This valuation is to be made simultaneously with a valuation of all public utilities in the District, by the Public Utilities Commission of the District of Columbia, in accordance with the provisions of the Act creating that Commission.

The grand concert of the Consumers Gas Company, of Toronto, was an unqualified success in every detail. The affair, which was presented under the auspices of the Education Association of the Company, was greeted with a packed house, and so great was the interest displayed, that those who took part had reason to be pleased with the success of the event. There were present: Mr. Arthur Hewitt, the General Manager of the Company; E. W. Allen, the Advertising Manager, who acted as Chairman, and Physical Director D. Allman. The Gas Company Minstrels, attired in white naval dress, created abundance of fun and were voted the hit of the evening. Those responsible for the success of the event, included F. Davies, stage manager; V. Farrent, manager of properties, and Interlocutor J. Dobson. Among the numbers on the programme were a violin solo by Henry Parr; baritone solo, H. Thomas; tenor solo, A. S. Long; reading by E. R. Guraud; a rendition of Tosti's "Good Bye" by E. Goad; solo, James Blower; a monologue by R. J. Salter. Miss L. Pope acted as accompanist in a most efficient manner.

The San Diego Gas and Electric Appliance Company, San Diego, Cal., are in the market for the following gas appliances: Independent circulating hot water room heaters, must be automatic and vented; circulating hot water house heat systems, quick acting, low temperature; industrial gas appliances of all kinds; bakers' appliances, including burners for brick ovens.

John Pettus, J. C. Mettert and James Gary have been appointed Gas Inspectors, in Richmond, Va., under a city ordiance, that requires inspection of consumers' gas fixtures and connections between the street mains and the meters. They are required to make report of all cases in which it is found that the fixtures are antiquated or inefficient. The gas user may follow the suggestion of such finding and replace them with fixtures of modern type, or may continue the use of the old fixtures. It is believed that the inspection and noting of inadequate means of utilization, will greatly improve the local service.

After a public hearing, in which no one appeared in opposition, except the attorney for the Buffalo (N.Y.) Gas Company, the Lamp Committee of the Board of Aldermen recently decided to recommend an amendment to the franchise of the Iroquois Natural Gas Company, permitting it to sell gas for illuminating as well as heating purposes. L. L. Babcock, for the Buffalo Gas Company, opposed the amendmend on the ground that the Iroquois Company had not asked for a new franchise, and should be compelled to abide by the terms of the one it now had. Any amendment of the Iroquois Company's fran-

chise by the common council will have to be concurred in by the Public Service Commission before becoming effective.

MR. WM. E. BARRETT has been retained by the Newport News and Hampton Railway, Gas and Electric Company to make an exhaustive examination and report on their properties in Newport News and Hampton, Va. Mr. Barrett will make general recommendations as to operations, extensions and improvements,

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THE generator house of the Ocala (Fla.) Gas Company was destroyed by fire on April 29th, but Manager Hunter and his men had the plant going again within 48 hours.

THE Haverhill (Mass.) Gas Light Company have men and teams busy placing pipe along the streets in preparation for the installing of gas in the town of South Groveland. They are also having a camp built on Main street, for housing the laborers who are to work for them. The town will have water pipes laid at the same time that the streets are opened for gas.

MANAGER SEYBOLT, of the Portsmouth (N. H.) Gas Company, is making arrangements for the holding of an exposition of the latest devices in gas appliances for the home, at Association Hall, on May 20, 21 and 22. The exhibit will be of especial interest to the thrifty housewives of Portsmouth, who seek to lessen their labors at home. Competent demonstrators will be present to explain the workings of the articles exhibited.

"C. M.," WRITING from Springfield, O., says: "Confirming recent rumors announcement has been made explaining the new organization plans of the Columbus Gas and Fuel Company, present owner of the Springfield Gas Company. Leading papers throughout the State are carrying detailed information and no extended comment is necessary here. The newly formed corporation, known as The Ohio Cities Gas Company, will own the Columbus and Springfield Companies and will probably take over the gas company in another large city near by. When the natural gas supply becomes exhausted, a huge artificial gas plant will be built to supply all the cities served by the Company, and it is said that the present plans are to put that plant in Springfield."

ST. PAUL (Minn.) will never lose Prof. Bemis, if he can help it. He now recommends that the city establish a Complaint Bureau, and it is probable his suggestion will be incorporated into an ordinance for consideration when the gas and electric rate question is again considered. He suggests that this bureau should investigate complaints of discrimination and service.

THE Chicago (Ills.) Commissioner of Gas and Electricity is advertising for proposals for furnishing, installing and maintaining approximately 1,000 ornamental incandescent gas mantle lamps on certain parts of streets in different sections of the city.

THE Western Gas and Electric Company have started laying gas mains throughout the streets of Sandwich, Ills., and the work will be pushed with all possible despatch until the whole town is supplied.

ATTORNEY SAMUEL ASSUR, representing the Stockholders' Protective Committee, was elected a Director of the Cincinnati Gas and Electric Company at the annual election. The others elected were: H. L. Brenneman, J. T. Carew, Edward H. Ernst, George D. Eustis, J. B. Foraker, Jr., Louis J. Hauck, Charles D. Jones, M. E. Moch, A. Clifford Shinkle and Charles F. Windisch. Mr. Assur was elected in place of H. W. Lothman.

THE Cincinnati Gas and Electric Company filed suit in the Common Pleas Court seeking to recover $44,847.89 special excise tax paid during the years 1910, 1911, 1912 and 1913. The payment was made under protest, it being claimed that the Union Gas and Electric Company had already paid the special excise tax, as the leasing company, and to compel the holding company to also pay would mean double taxation and an illegal assessment. The suit is practically along the same lines as a suit filed by the Cincinnati Street Railway Company some time since, in which the excise tax paid by it is sought to be recovered, on the ground that this tax was also paid by the Cincinnati Traction Company, the leasing company.

SHAW & CO., of Philadelphia, have been awarded the contract by the Luzerne County Gas and Electric Company, to lay 4-inch gas mains from Breslau across the new river bridge to Plymouth, Pa.

CITIZENS of Methuen, Mass.., are discussing the contract with the Lawrence Gas Company which expired in November. In the past the town has paid $17 a year for each light, and under the new contract the lights can be secured for $16 per year. There are many who favor making a contract for all night lights, which it is understood will cost about $20 per light.

THE Atlanta (Ga.) Gas Light Company, is extending its mains to and through the thriving suburban town of Decatur, and are about ready to make house connections.

THE City Council of Johnson City (Tenn.) is considering the granting of a gas franchise, and the ordinance is about ready for its final reading. Two companies are competing for the grant, represented by Wagner & Dunn and Kuemmerle & Co., of Philadelphia.

THE improvements contemplated by the Pacific Gas and Electric Company, in its gas department, include the installation of new water gas generators, at a cost of $250,000, and extensions of the gas distributing system. The output of the gas plants of the Company in San Francisco, is now averaging about 14,000,000 cubic feet a day.

THE authorities of Bay City (Mich) are considering amending the franchise of the Bay City Gas Company, so as to specify a heat unit standard in place of the present regulation calling for 18 candle power gas. For the purpose of being in a position to test the gas, both as to candle power and heat units, and to test meters, the Council unanimously adopted the recommendation of the Ways and Means Committee, that the necessary apparatus be purchased, as recommended a week ago by the Board of Public Works.

THE Grand Rapids (Mich.) Gas Light Company gave a banquet to the members of the Grand Rapids Coal Exchange, at which Mr. Glenn R. Chamberlain, Secretary of the Company, presided as toastmaster. The handling of coke and other matters were discussed by Mr. J. T. Young, Vice-President and General Manager of the Company, and announcement made of the summer reduction of 50 cents per ton.

THE Massachusetts Legislature is considering a bill which provides that when a city or town votes to establish a gas or electric plant, it shall purchase any private electric or gas plants within the city or town limits if the owners of such plants elect to sell. The price paid by the city or town is not to include mortgages or other incumbrances.

THE new coal gas plant at Fall River, Mass., began making gas last week, and its output is being mixed with the water gas from the Anawan street plant. The mixed gas distributed is described by local papers as "giving general satisfaction to consumers."

"D. T.," writing from Corpus Christi, Tex., advises us that work on the plant and mains of the Corpus Christi Gas Company are being vigorously pushed toward completion. While work on the mains was not entirely suspended, it was allowed to drag along, but now more pipe has arrived and orders have been issued to rush the plant construction. The time limit for supplying gas under the franchise has been extended to Sept. 28, and it is expected gas will be in the mains by that time.

KINGSTON, N. C., is promised a gas plant in operation by January 1st, next. The City Council unanimously passed the franchise after its final reading. Twelve miles of mains will be laid to begin with, and the plant and equipment will cost $100,000. The price in 1915 will be $1.60 per 1,000 cubic feet, in 1916, $1.50, and after that it will be sold on a sliding scale, governed by the increase in consumption, etc. The same company will install a plant in Wilson, N. C., and probably in Johnson City, Tenn.

THE Brenham (Tex.) Gas Company reports large increases in gas sales, and considerable demand for main extensions. Work has been started on a main for East Sycamore street, where many new consumers will be booked up.

Utilities Commission News.

ILLINOIS COMPANIES MUST REVERT TO FORMER RATES.—The Illinois Commission, because of numerous complaints as to the rate advances since July 1st, 1913, has announced that all utility companies must continue their former rates until they comply with the utilities law. The utilities law requires any public utility wishing to make an increase in rates to apply to the Commission and show cause why the proposed advance should be made. According to the Commission, many of these companies have advanced their rate schedules since July 1st, 1913, without first applying to the Commission, and these advances will have to be suspended until proper application has been made and passed.

NEW JERSEY POLICY IN DEALING WITH MUNICIPAL REGULATION.—The Commission holds that local regulation must give way to State supervision. "The board does not assent to this limitation of its powers either to fix rates or regulate service. Since the passage of the acts creating this board and defining its powers, the power of municipalities to impose conditions upon public utilities in the exercise of franchise grants and to provide by contract respecting rates and service is subject to the authority and control of this board to fix rates and regulate service. While this board has power to fix rates and establish rules and practices governing service without regard to ordinance provisions and contracts between municipalities and utilities, we would not feel disposed to exercise such power to relieve a utility from a burden assumed by such ordinance or contract in any case where it appeared that a municipality or its inhabitants would under such ordinance or contract receive rates or service more advantageous than this board would be justified in ordering, unless it appeared that such ordinance or contract imposed terms involving such loss and hardship as to make it impossible for the company to render safe, adequate and proper service. A company may agree to give rates and service upon terms that will not accord to its stockholders a fair return upon the capital invested. We would not be disposed to permit an increase of rates in any case where an agreement between a municipality and a utility exists, if the only benefit from such increase of rates is an increase in dividends. In such case the company would be presumed to have acted with a knowledge that its earnings would be reduced by such terms and to be willing to wait for adequate returns upon the investment. When, however, the effect of ordinance or agreement provisions is to impair service, such provisions will not be permitted to stand in the way of such order as this board deems necessary."

FINDLAY, O., TO PROTECT ITS PIPES.—The Ohio Commission has ruled that it is without jurisdiction to determine the authority of the City Council of Findlay to pass an ordinance to prevent damage and injury to iron pipes laid in the streets and public ways by the escape of stray currents of electricity from traction companies' transmission lines. This is the ruling laid down in dismissing the complaints of the Toledo, Fostoria & Findlay Railway Co. and the Toledo, Bowling Green & Southern Traction Co. against the action of the municipality.

MUNICIPAL LIGHTING PLANT AT SHEBOYGAN NOT DESIRABLE.—The Wisconsin Commission has refused the application of Sheboygan for a certificate of convenience and necessity to permit it to construct a municipal lighting plant, on the ground that the Sheboygan Railway & Electric Co. was not furnishing adequate service.

Counsel for the light company stated that there had been a change in ownership in the utility and that the new owners were willing to install equipment capable of furnishing adequate and satisfactory service.

"The attitude of the Commission towards applications for certificates of convenience and necessity to duplicate existing plants is well known. It rests upon the recogized fact that an existing plant can be made to give the public better service and at a lower cost than can competing plants. It requires no argument to prove that competing utilities in any municipality add to the service burdens of the public, rather than lessen them."

UTICA REDUCTION.—The Second District Commission, State of New York, has ordered that the Utica Gas and Electric Company reduce rates on July 1st, 1914, to $1.10 net for light, and $1 net for fuel; and on July 1st, 1916, to $1 net for all gas; gross prices to be not more than 10 cents additional. No ruling was made on the question of authorizing a 50-cent monthly minimum, and if imposed by the company it will be subject to review on complaint. The prices named in the order had been agreed upon between representatives of the company and of the citizens of the district.

Financial Notes.

THE Brooklyn Union Gas Company showing for 1913, a deficit of $463,958, compared to 1912, credit balance of $214,850 is explained by the larger amount set aside for depreciation account, and the increased costs of manufacturing materials. The gain in gross earnings for 1913 was 2¾ per cent., and indications are that 1914 will increase by 5 per cent.

THE gross earnings of the 67 companies managed by the Stone & Webster Management Association in 1913 were $26,688,521; net earnings, $1,104,764. They paid an interest charge of $4,432,104, dividends of $4,184,476, and had a balance for reserves and depreciation of $2,010,863. The street railways owned 1,299 miles of single trackage and carried 341,255,000 passengers. The electrical properties developed a commercial power load of approximately 179,880-horse power and an electric lighting load equal to 2,414,820 16-candle power lamps. The total gas output was 1,754,158,300 cubic feet. The various companies employ about 20,000 men.

THE Union Gas and Electric Company, in a letter to City Solicitor Schoenle, of Cincinnati (O.) asks the City for a loan of $120,000, to defray the cost of laying gas mains to Sayler Park and the lower river suburbs. It will require 90,000 feet of gas mains to reach Sayler Park, of which 23,400 feet will parallel the present low-pressure mains, which are adequate for the service now rendered, but not large enough to carry the volume of gas needed at a greater distance. The Company officials were told that if their corporation would guarantee the interest and sinking funds on the bonds, there might be no objection to the city becoming the financial backer.

THE Columbus (O.) Gas and Fuel Company has declared the regular quarterly dividend of 1 per cent. on its common stock, payable June 1 to stock of record, May 15.

THE New York and Richmond Gas Company, in its annual report for 1913, showed an operating income of $355,821.43, an increase over the previous year of $19,603.80. Net corporate income was $46,809.26, a decrease of $40,374.95, and surplus at the end of the year was $153,611.34.

The Queens Borough Gas and Electric Company (N.Y.) in 1913, had an operating income of $334,852.83, an increase of $29,705.44. Net was $86,506.63, an increase of $27,818,12, and surplus was $229,810.71, an increase of $67,633.19.

The Bronx Gas and Electric Company (N. Y.) reports operating income of $150,657.38, an increase of $8,051.66, and a net corporate income of $33,175.90, a decrease of $727.81. Surplus at the end of the year was $64,093.46, a decrease of $2,504.81.

AT the annual stockholders' meeting of the United Gas Improvement Company recently, Samuel T. Bodine was re-elected president, and all the other directors were re-elected by an unanimous vote of 766,109 out of 1,110,059 shares.

THE Laclede Gas Light Company (St. Louis, Mo.), reports for the quarter ending March 31st, gross earnings, $1,229,809, an increase of $48,236; net, $516,621, a decrease of $15,316. After paying interest and preferred dividends, $214,310 is left for the common stock.

THE Consolidated Gas Company, of New York, reports operating revenue for 1913, $14,155,419, an increase of $153,690 over 1912. Operating expenses were $9,769,287, an increase of $103,177; and net corporate income, $8,487,804, a decrease of $405,497. The surplus at the end of the year was $15,031,540, an increase of $2,416,981.

FOR March the Consolidated earnings of Kansas Gas & Electric, Portland Gas & Coke Co., Pacific Power & Light Co., and the Southwestern Power & Light Co., operating companies of the American Power & Light Co., were $515,610, an increase of $55,797, or 12 per cent. over March, 1913, with an increase in operating expenses and taxes of $27,926, or 10 per cent. Net earnings were $217,180, an increase of $27,871, or 15 per cent.

THE Astoria Light and Power Company has filed a mortgage for $5,000,000 in Jamaica, L. I., made out to the Farmers' Loan and Trust Company, covering all the property owned by the Astoria Company, which is part of the Consolidated gas system, and embraces the property of what formerly was the Citizens' Mutual Gas and Light Company of Long Island City.

The indenture provides for the issue of 5,000 fifty-year gold bonds of $1,000 each, bearing 5½ per cent. interest.